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THE NATIONAL STAKE

Can any government be complacent over its forest resource developments and its forest administration? The 1952 Annual Report of the U. S. Forest Service offers an answer to this question for the United States in a striking presentation of "America's Stake in World Forestry."

The Chief of the Forest Service points out that the condition of the forest and range lands, which comprise a major portion of the world's total land surface, affects the welfare of millions of human beings. He confirms unequivocally what FAO maintains: that the way governments handle their forest and range resources and how well they are able to maintain or improve forest and range productivity will determine not only their national strength and standard of living but also their very survival.

The report, using FAO statistics as a basis for much of the information on forest resources, describes the world's timber supplies, shows the relationship of forests to living standards, predicts that the world's needs will increase, and discusses the possibilities of increasing production in Canada, Western Europe, Latin America, central and south Africa, southeast Asia and Oceania. It emphasizes the timber deficits in North Africa and the Near East, the need for rebuilding rather than heavier cutting in European forests, and the necessity for expanded reforestation in the critical situation in Japan. It covers the trade in the principal forest products, particularly lumber and pulp and paper, which America enjoys with other countries.

Against the background of these facts the opportunities for meeting the greater needs for forest and range productivity and output are presented. How are these opportunities to be faced; how are these needs to be met? The key, according to the U. S. Forest Service, is to be found through complete co-operation with other nations, primarily by means of a world forestry movement.

Emphasizing the need for sound forest policy for each nation, the report summarizes the "Principles of Forest Policy" adopted by the FAO Conference in 1951, and points out that "few countries have adopted such a comprehensive policy. Even the United States, in which the conservation movement has made notable progress during the past half-century, falls short in some respects."

Describing the quite considerable measures of American participation in the world forestry movement, the Chief drives home the point that overseas assignments for American foresters in technical assistance programs and the training given to visiting foresters in the United States develop better understanding and are of distinct benefit to forestry in America. Furthermore, the Forest Service places itself on record as wishing to continue its strong support for this work of bringing to the world's forests "the touch of forest management."

This then is the objective: to put the work of the Forest Service on a basis sound and strong enough at home to meet domestic requirements and to make as effective as possible U. S. support to the world forestry movement.

Can there be any doubt that a country, to make its maximum contribution to world forestry, needs to have a clear forest policy, an administrative service with well-defined responsibilities and authority, strongly developed co-operative relations between government and private forest and range resource owners and operators, sound technical guidance by a scientific research organization, and constant recruitment from schools of high standards of well-trained technicians for both public and private service at home and abroad? Can any nation be complacent about the stage of development of its forestry services?

The American answer is, of course, an emphatic "NO!"

IN WORLD FORESTRY

Unasylva

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Cover Photograph: *Carved motifs of fauna and flora forming part of the English oak paneling given by the United Kingdom to the permanent Headquarters building of the United Nations at New York. The last FAO Conference invited Member Governments to donate furnishings or suitable samples of their native crafts to FAO Headquarters, to make the building a living testimony to the varied traditions of fine art and craftsmanship of its member nations.*

TIMBER TRENDS AND PROSPECTS

THE variety of FAO's work in technical assistance is illustrated by photographs elsewhere in this issue. By and large all this work has the same ultimate goal — that forests should make a maximum contribution to the welfare of the world's peoples, an objective which will in part be achieved if the largest possible amounts of forest products are efficiently used.

But a word of caution is necessary. Increased forest production must be based on assurances that markets will be available for additional produce. Questions must be posed and answered before governments can decide, as an important part of their economic policies, what priority should be given, for example, to the development of hitherto unexploited forests against competing claims for the limited investment resources available. Investors must be satisfied as to the fair prospects of, for instance, new industries for making pulp and paper.

Why strive purposely for greater production? Why not rely on the free play of economic forces to equate consumption and supplies? To acquiesce in such a solution would be to abandon tamely one of the main aims of the United Nations — freedom from want.

This is not to say that the promotion of increased production should not be based on careful analysis of future prospects. An example of the kind of analysis meant is the study on *European Timber Trends and Prospects* recently published jointly by the United Nations and FAO. This study carries analyses of the European picture to the limit permitted by the available material, and provides essential knowledge about trends in production, consumption and trade, and orders of magnitude, of relevance to policy decisions.

Similar studies, though not necessarily of the same detailed pattern, could advantageously be made to cover other areas of the world and to serve as a basis for international action. In that way, at least we should know that targets for increased production were not straying into the realm of fantasy or founded on unrealities.

It is the duty of FAO to work for progress, but there is not much hope of satisfactory achievement unless the targets aimed at can be proved both necessary and possible.

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Unidades Industriales de Explotación Forestal

A System of Organized Forest Exploitation practised in Mexico

by Louis Huguet,

FAO Technical Assistance Mission, Mexico

A large — often preponderant — part of the forested area is in many countries in private ownership. All kinds of attempts have been made to persuade owners to manage their forests in the public interest and in keeping with governmental forest policy, and these efforts have in fact often met with partial success. Perhaps owners have been more ready to co-operate because the concept of property rights, which, under the influence of Roman law, were still held almost inviolate less than a century ago, has been changing rapidly into a feeling of public responsibility. It must be admitted, however, that nowhere has the problem of private forest property been completely solved.

True, there are in most countries private forests that are remarkably well administered. But as a rule, the interests of the private owner rarely coincide with, and are in fact often at variance with, the public interest. One difficulty is the frequent fragmentation of private forest property into units that cannot in any case be profitably managed, and this is further aggravated by the technical incompetence of small holders who cannot unaided be expected to keep up with the complexities of modern forestry and silviculture.

In some countries where modern methods of industrial or agricultural development have been recently introduced, most of the forests are state owned. But even here the very extent of the forests usually makes intensive management impossible. Exploitation is carried out on a concession basis, with an obligation on the part of the operator to take care of reforestation and improvements, to build houses for forest rangers, and so forth.

Under these conditions, it is extremely difficult for national forest services to keep a close watch over fellings and the silvicultural methods employed by the concessionaires. In places there is a generally favorable trend towards good practices, but too often strictly legal obligations are observed without either technical skill or judgment. Moreover, there is always the difficulty of recruiting and maintaining, on the local budget, a forest service to direct felling operations and supervise work undertaken in virgin forests which are without communications and where there is no capital to put into such improvements.

As a result of particular historical and geographical factors, these two major problems of modern forest policy — private ownership and the creation of an efficient forest service for vast expanses of virgin forests — are inevitably encountered in a young country with a future. Such is Mexico, which has immense forest resources covering an area of some 20 million hectares. An attempt has been made by Mexico to solve these two problems simultaneously by an ingenious method which is of considerable interest. This is the system of *Unidades Industriales de Explotación Forestal*. Neither Mexican forestry legislation as a whole, nor those parts specifically concerning *Unidades* can be transposed elsewhere without serious risk, since, like all other national legislation, it is adapted to special conditions that have no exact counterpart elsewhere. Other countries, however, facing similar problems and with similar conditions, may be able to derive some profit from Mexico's experience.

General remarks on Mexican forests

Some general information on Mexico[1] and its forests is essential to a proper appreciation of the system of *Unidades*.

The total land area of Mexico is roughly 2 million km.^{2}, or about four times the size of France. Although the country stretches from latitude 32° N. to 16° N. and is bisected by the Tropic of Cancer, only those parts below an altitude of 1,000 meters, comprising less than half the total area, have a typical tropical climate. Pine makes its appearance at 1,000 meters, and at 2,000 meters and over, there are extensive forests of conifers (pines and firs), some of which have never been worked, although they are periodically swept by surface fires. Even without precise figures, the total area of softwood forest may be estimated at 10 million hectares which, if not all immediately ready for systematic exploitation, could be after 20 or 30 years' protection against fire, grazing and indiscriminate cutting. Except in the north, the forests have a potential yield of 3-12 m.^{3} per hectare per year, with an over-all average for the country of 5 m.^{3} With the adoption of sound management and silvicultural methods, production could be raised to 50 million m.^{3} a year.

Tropical forests relatively rich in valuable species such as mahogany, little worked and covering at least as extensive an area as the pine forests, are to be found mainly in the south and southwestern parts of the country (Yucatan Peninsula).

The pine forests are massed in the higher parts of the country in large compact stands. Although nature has grouped these forests together, ownership is split up. Many of them are communal forests, known locally

[1] "Les forêts et les industries forestières au Mexique." P. Allouard. *Bois et Forêts des Tropiques*, No. 15, 3rd quarter 1950.

as "ejidales," the property of communities ("ejidos"); it should be remembered that the Mexican agrarian laws turned over the estates ("haciendas") of the Spanish colonists to these "ejidos." There are few state forests. Mexican forests, therefore, present a dual character, in that ownership is variously split up between the State, "ejidos," and private individuals, while exploitation retains the features of the old "colonial" system. Management is thus handicapped simultaneously by property rights (and fragmentation) and by "colonial" attitudes.

The legislation that had to be introduced for the development of such great potential forest wealth had to have due regard for the country's agrarian system. The result was the system of *Unidades Industriales de Explotación Forestal.*

Legal background of the Mexican Unidad *System*

A Forest Law was promulgated on 10 January 1948. According to Article I, subsequently amended by a Decree of 30 December 1948, the Law is based on Article 27 of the Constitution which authorizes State control and conservation of the country's natural wealth and regulation of its use, and declares that the conservation, improvement and restocking of the forest is in the *public interest,* with all the legal consequences that such a declaration entails. This basic Article draws attention to the fact that many Supreme Court decisions have confirmed this declaration. In other words, the State is perfectly justified in enforcing its authority, when necessary, to ensure forest *conservation, improvement* or *restocking.*

The chief characteristic of the legislation, unknown in most countries, is that while it *disregards property rights,* it still retains the principles of private ownership, as will be seen later. Another original feature is that the Law considers as matters of public interest not only the forest's function in soil and water conservation, but also its role as a producer of timber, as is set forth in Article 13: "the creation by Presidential Decree of *Unidades Industriales de Explotación Forestal,* both in public and private forests, with the object of supplying the raw material necessary for the woodworking industries, is deemed of public interest."

The Law extends the *Unidad* system to communal or "ejidales" forests, with certain allowance for the special legal status of the "ejido": private forest areas, sometimes as large as half a million hectares, can be placed under the *technical jurisdiction* of the State. In principle, any decision as to fellings no longer rests with the owners; the State decrees the time, place, manner and extent of cutting. With these exceptions, the owner retains all the other privileges inherent in property rights. The State manages the *Unidad* forests through the Directorate-General of Forestry, in practice through the office of the Technical Manager of a *Unidad.*

The principles governing the organization and working of the *Unidad* are defined in special regulations which have the force of a decree, since they were signed

FIG. 1: *The results of fire, uncontrolled grazing and indiscriminate cutting.* Pinus leiophylla *forest in Mexico.*

FIG. 2: *With the adoption of sound management and silvicultural systems, production can be raised considerably. Forest of Los Capulines.*

by the Head of the State and by the Ministers concerned, and promulgated on 12 July 1950.

They provide, in substance, that:

1. It must first be ascertained that a proposed *Unidad* is of public interest (Article 124). This is done either by demonstrating the need for, and possibility of, supplying raw material to an industry, or by showing the economic advantages that the country would derive from it.

   The survey must fulfil certain conditions defined under Article 125:

   (*a*) A map must be submitted of the sector proposed for supplying the industry to be established;

   (*b*) A set of general operating rules must be drawn up covering the products (pulpwood, sawlogs, etc.) to be extracted, methods of processing these products and the amount of capital necessary for the purpose; the latter has to be justified by a preliminary plan of the consumer plant.

   Article 125 also provides that a plan be made of all privately-owned estates involved which amounts, in fact, to the establishment of a forest property register.

2. This preliminary survey must be studied by the Ministries of Agriculture and Economics and transmitted by them, together with their comments, to the President of the Republic for his decision.

The organization of the Unidad

While this system obviously furthers the common good (by the subordination of property rights to general welfare), there is no doubt that the consumer industry also derives considerable benefit from it, for in this way it is assured of regular supplies guaranteed by the State. It must not be forgotten that in Mexico certain industries previously owned large tracts of forest from which to draw their regular supplies, and that they were dispossessed by agrarian reform laws. The law thus deprived the large mills of their sources of supply, and as the suspension of their operations could not but have had considerable economic and social repercussions, it was both logical and essential to take legislative action to replace the source of supply by another whose permanence could be guaranteed. From this point of view, the creation of *Unidades* would appear to lessen the adverse effects of the agrarian reform laws on the woodworking industries.

This guarantee of sustained supply, together with knowledge of the size of *Unidad* which is legally per-

missible, enable the industrial concerns to arrange the large capital investments needed to set up modern wood-preserving factories (at least U. S. $ 6 million for a paper mill and U. S. $ 1.5 million for a fiberboard factory). Also, as it is appreciated that a variety of wood-processing plants are indispensable to the optimum utilization of the forest, careful planning for the integration of a number of industries using forest products, including waste, is possible.

The choice of the industrial concern for each *Unidad* naturally rests with the Government. It is thus possible to eliminate any concerns suspected as being likely to adopt a forest policy contrary to the public interest. It is conceivable, for instance, that a firm with little capital might seek to amortize its investment rapidly and inflate profits by overfelling in stands which should provide sustained supplies. A makeshift sawmill could, for example, exhaust a forest in a few years and abandon it after making a great deal of money without investing much capital. A paper mill, on the other hand, which is very expensive to set up, is more likely to have the greatest possible interest in conserving the forests which it exploits.

A guarantee of serious interest by any concern is the size of the investment required. A recent Government circular compels *Unidades Industriales* to invest at least Mex. $600,000 (U.S. $65,000) apart from monies required for road building, and the Government can demand investment not only on the industrial side but also on the purely forestry side (nurseries, silviculture, etc.).

The forest engineer in charge of the *Unidad* is appointed, housed, and paid by the industrial concern, but he receives his instructions from the National Forest Service. He remains a civil servant, and the backing of the National Forest Service gives him the moral authority to oppose all pressure contrary to national interests. The management plan which he draws up for the *Unidad* must be approved by the Forest Service. It is well known how difficult it is to draw up a detailed management plan, for tropical forests in particular, and it is equally difficult to implement it properly. The creation of *Unidades* is therefore far from doing away with the need for an official forest service because an intelligent and technically competent supervisory body is still required to exercise control in the field. The system may cut down the number of employees on the State payroll, but it increases their power.

The system in practice

Eight *Unidades* have already been formed in Mexico, three of them, covering a total area of some 400,000 hectares, to supply paper mills. There are two *Unidades* in tropical forests covering 1,600,000 hectares; the main product of one is mahogany (*Swietenia macrophylla*) which is exported as sawn timber; the other produces cedar (*Cedrela odorata*), which is exported as plywood.

Ciudad Guzman (*Jalisco*) Unidad

Let us now examine the individual decrees establishing one particular *Unidad*, for example, the Ciudad Guzman (Jalisco) *Unidad*. It comprises 130,000 hectares of forest, mainly pine, divided among more than 1,000 different owners.

The Decree provides for "the establishment of an industrial *Unidad* for forest utilization to supply a consumer industry with wood pulp, cellulose and fibers."

According to Article 3 of the Decree, the Office of the Technical Manager of the *Unidad* shall receive instructions directly from the Central Forest Service, but the Manager shall be appointed by the consumer industry, with the approval of the Directorate-General of Forestry, and be paid by the industry.

It is also stipulated that the consumer industry shall finance the running of the *Unidad*, be responsible for the supervision of the forests, and spend at least 250,000 pesos (U.S. $ 30,000) a year on a reforestation program. There are no instructions in the Decree on the type of management for the forests themselves.

It should be added that the owners are paid for their wood at pre-arranged rates agreed between the consumer industry and the owners.

On this legal basis (the law, its regulations and the Establishment Decree) and on a management plan ("Proyecto de Ordenación"), the Ciudad Guzman *Unidad* appears to function both effectively and efficiently.

The *Unidad* Technical Manager has several subordinates under his immediate orders (3 engineers in charge of forest sectors, and the heads of general services: forest police, nurseries, reforestation, and administrative services); and this group is sufficiently small for him to be able to direct and supervise it efficiently. Thus it is possible to decentralize control and increase the responsibilities of the subordinates.

The equipment (stocks, tools, and various supplies) is well suited to its purpose and sufficient in quantity to enable each officer to do effective work.

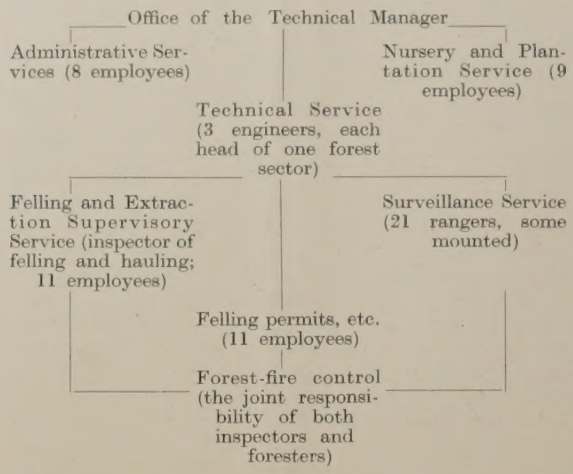
The staff is adequate to begin surveillance and intensive management of the stands, although each ranger ("montero") is responsible for approximately 7,000 hectares of forest. In the near future it is proposed by additional recruitment to reduce this figure to 2-4,000 hectares.

Salaries and wages are comparable to those paid in private industry. It is almost certain that the actual cost of each job is ultimately less than if low salaries were paid. Certainly the whole staff seems to be keen and interested in the work, and the industrial management shows a real understanding of forestry interests which are, fundamentally, its own.

Total number of employees is 61 for 130,000 hectares, or almost one employee per 2,000 hectares, which is a good proportion and comparable to that obtaining in countries with a long tradition of intensive forest management.

Such an organization has not many equivalents in the forestry world today. It might, at best, be compared with the system built up by the owners of large private estates in Europe to improve the management and utilization of their forests, but there are few such great estates left in the world today. A parallel might also be drawn between the organization of the *Unidad* and that of the great state forests of western European countries, with the difference that in these countries the Forest Service is not usually directly linked to a wood-using industry which has exclusive rights to the forest products; in fact, the service is more often estranged from the consumer industries or logging concerns which obtain their concessions each year by public tender.

The forestry side of the organization of the *Unidad* is given in the following table:



The *Unidades* may also be compared with the Co-operative Sustained Yield Management Units or perhaps forest farms of the United States. The Units, however, usually group together, for the benefit of a particular private company, only the forest belonging to that company and the appropriate state forests, with a view to ensuring sustained supplies to the industry and sound management of all the forest stands that feed it. Such a grouping is on a voluntary basis and the law authorizing the establishment of such co-operatives has come in for much criticism, on the grounds that private concerns are in this way being granted monopolies in state lands.

Conclusions

The implementation of the existing legislation as exampled at the Ciudad Guzman *Unidad*, appears to show that:

1. the creation of *Unidades* presupposes the existence of suitable forests that can be worked on an economic basis, since the very formation of a *Unidad* is contingent on the particular industry which the forest must sustain. A *Unidad* embracing forests not immediately capable of yielding a reasonable return would presumably have to be subsidized by the government, unless credit institutions assisted, which is not inconceivable if there were definite promise of improved output;
2. there would be advantages in establishing some similar system in countries where the official Forest Service has not itself the means of carrying out intensive management. This would apply particularly to those countries where, because of reluctance on the part of the government to grant funds or authorize recruitment, the forest services have a small budget or are under-staffed. By the *Unidad* system, the woodworking industries themselves must provide the technical forest services which, provided they are given sufficient freedom of action, should be able to guarantee proper management of the forests.

The Law relating to *Unidades* provides Mexico with a system entirely suited to the country's particular economic and social conditions. Its success will undoubtedly very much depend on the way the law is implemented. There are few *Unidades* as yet and in practice there are still a number of unresolved problems. Ideas abound on this system; some have been translated into law but many have not yet been confirmed as sound in practice. But under the existing legislation, one *Unidad* at least has shown itself over the past few years capable of being operated *effectively and efficiently in the interests of the forest and of the general public.*

The system ensures close collaboration between the timber industry and the official Forest Service. Operators are no longer the destructive forces of bygone days; they now have a better idea of their responsibilities. Timber industries and derivative industries (paper, plywood, fiberboards, etc.) are making increasingly large capital investments so that they must obtain, in their own interests, a sustained (if not maximum) yield from the forest. Thus, in most cases, the establishment of *Unidades* is accepted by the companies rather than imposed on them by the State.

Finally, a realistic attitude must be taken towards the traditional institutions of the past. In many countries the power of the official forest services does not grow commensurately with the increasing importance of forests and forest products. National budgets, now burdened by military expenditures, are apt to neglect the forest services, so that their scope of action is severely restricted. A more direct link between forest services and the *actual sector* where the forest wealth is converted into commodities that can be sold or exchanged (that is to say, the wood-using industries) can obviously provide forest services with the means of raising the forest yield because capital is in such cases made available to put back into the forest.

Altogether, the *Unidad* system appears able to help raise the status of foresters and at the same time provide a means of ensuring sound forest management under circumstances in which otherwise it would be difficult to achieve results.

Spaced-Group Planting

by Mark L. Anderson,

Professor of Forestry, University of Edinburgh, Scotland

The artificial establishment of new forests, or re-establishment of former devastated forests, constitutes one of the most important tasks of modern forestry. Moreover, artificial restocking is also commonly practised in forests which have for long been run under scientific management, wherever natural restocking is inadequate or, for some reason, impossible.

Until relatively recently and, so far as is known, without exception, artificial regeneration has been planned in such a way that the units employed in the process of planting or of sowing — whether that unit has been a single tree or a clump or group of trees or a quantity of seed — have been uniformly distributed according to some regular pattern over the area to be regenerated and in such a way as to ensure that the whole surface can become covered as quickly as possible with a complete canopy, lacking gaps or openings.

So much stress has usually been laid on the need for ensuring this regularity and completeness that it has become the normal practice to beet, repair or fill in, during the early years of the stand, all or most of the gaps due to the death of individual plants used in the initial establishment.

Yet the process of natural regeneration as it goes on in the natural forest, or as it is guided under those silvicultural systems which make use of the ability of forest stands to reproduce themselves by seed, almost always results in a structure of stand which is very far from being such that the individual trees are evenly spaced all over the ground. It is normal for the young stand not only to be slightly uneven-aged, but to consist of individuals very irregularly distributed. Dense groups composed of numerous individuals are scattered about, interspersed with isolated single trees and with many blank areas of varying extent.

As time goes on these irregularities tend to disappear as the individual trees become larger so that they not only eliminate many of their smaller rivals but spread their crowns over the small areas of unoccupied ground. Ultimately the whole stand may assume great regularity of spacing but may not necessarily consist of trees of uniform size, stem-form, crown-shape, branch-size or knottiness, nor of uniform stability. These attributes must vary according as the now mature trees have grown originally in isolation or as members of dense groups.

In the managed forest it is, of course, possible, by tending fellings, to influence the development of such a stand and to alter favorably the proportions of desirable and undesirable trees. It is, in fact, much easier to carry out this operation in stands of such a structure than in those which are formed by the hitherto orthodox regular planting methods. The mere fact that the trees in an orthodox stand are evenly spaced means that the thinning operation must follow a rigid pattern and that it is very often impossible to remove undesirable stems because their absence will leave too large a gap and result in loss of production and of stability. Where there are dense groups of stems in a stand, there is a much greater choice in making tending fellings and it is much easier to ensure that the area originally occupied by a group will at later and mature stages carry at least one good stem.

Further, observations of the type of stem produced in natural forests — with small taper, absence of knottiness and of coarse branches — led many foresters to assume that if trees of similar high quality were to be grown in artificial stands, close spacing was essential. In the last century, for example, close spacings were the general rule in planting operations. This had no obvious serious consequences on poorer sites where the rate of growth happened to be slow and where growth was often irregular, or on deeper soils with stable deeprooting trees. When fast-growing species came into more general use, however, and especially where there were shallow-rooting trees planted on thin soils, the stands produced by regular spacings of from 1 to 1¼ meters quickly became very unstable, and it was often impossible to lead them safely on to saw-timber size.

The reaction to this, as well as to the very high costs in these days of planting so many trees to the hectare, has been to increase the spacings to 1.5, 1.75 or even 2 meters. This has certainly increased the stability of stands but it has depreciated the quality of the timber produced and that in turn has led to the modern cult of artificial pruning, with all its attendant disadvantages.

It would appear, therefore, that any attempt to imitate the methods of natural reproduction by means of a uniform spacing with short intervals between the stems is likely to fail. Once it is accepted, however, that natural reproduction does not mean any such thing but that in the initial stages of a natural stand the keynote is great irregularity of spacing, it becomes desirable to modify artificial methods to resemble more nearly those of nature and this is the main object of the recently proposed method of spaced-group planting, the basis of which is an acceptance of the fact that trees grow best in dense groups but that to achieve this economically *it is necessary to leave a proportion of the planting area unstocked for a longer or shorter time.* The method proposed is one of dense groups, widely spaced.

History of the Spaced-Group Method

So far as is known, the first suggestion that some method of planting by means of dense groups widely spaced might be the subject of experiment was made by the writer in 1928 (4) in the following words: "It is suggested that if first-class timber is to be produced,

trees must be grown as closely as possible, consistent with sound economy; that the best way of economizing is not to increase the planting distance from 3 feet to 6 feet (0.9 to 1.8 m.) or more... but simply to increase the average planting distance by an equivalent amount and to achieve this by instituting a method of planting in dense groups. The trees in the groups may be only from 2 to 3 feet (0.6 to 0.9 m.) apart, but *there would be large gaps between the groups not planted at all, etc.*"

Suggestions were then made on how this theory might be applied and the possible advantages of the method were discussed, in a subsequent paper by the writer in 1930 (1), supplemented by a third paper in 1931 (2) which suggested additional possible advantages in the method.

During the years from 1929 to 1932, while the writer was employed on research work by the Forestry Commission, quite a number of experiments were laid down for a variety of purposes, in which the planting was done by means of dense groups, widely-spaced. A few experiments were even carried out to compare different group structures and spacings. Some of these experiments have been reported upon recently (3) and the results to date discussed.

During the period of the writer's service in Ireland a considerable number of small areas were planted in several forests by the new method, mostly with the object of testing its utility in the growing of broad-leaf trees with conifer nurses. These areas which were planted for a period of years beginning in 1934 remain to be examined and reported upon.

In addition to these areas established by State services in the British Isles, a very few small areas were planted by private forest owners, soon after the idea was mooted. In addition, the Director-General of the Belgian Forest Service, M. Turner, adopted and adapted the idea in his technique of conversion of even-aged, pure stands to mixed irregular stands in the Ardennes (5) and also applied it to a small area he himself owned. Apart from this, little interest appears to have been taken in the proposed new system. It was stressed initially, however, that a good deal of experiment would be required before the best application of the system could be evolved, and that it would have to be varied according to circumstances.

A period of over 20 years has now elapsed since the method of planting by means of dense groups widely-spaced was first tried out and, while it is still too soon to draw definite conclusions, the stage has now been reached where it is possible to recommend that it might be much more widely tested out. It is a very flexible method with infinite possibilities for modification and the time has come for appealing for a wider interest in its use. The writer is grateful for this opportunity for spreading the idea over a wider field.

Technique of the Spaced-Group Method

The spaced-group method is based on two fundamental principles, namely: (*a*) that the planting unit should consist of a group of trees and not, as in the orthodox method, of one tree only or of one small pinch of seed when sowings are employed; and (*b*) that the planting units should be so spaced over the planting area that a considerable proportion of that area remains unstocked and is left unplanted between the units.

Within the system there can be variations of procedure of five different kinds, namely: (*a*) of the number of trees constituting the planting unit; (*b*) of the composition of the planting unit; (*c*) of spacing between the individuals within the planting unit; (*d*) of spacing between the planting units; and (*e*) of mixing pure planting units.

In addition, there can be a wide variety of combinations of all these variations, which justifies the claim that the system is a very flexible one.

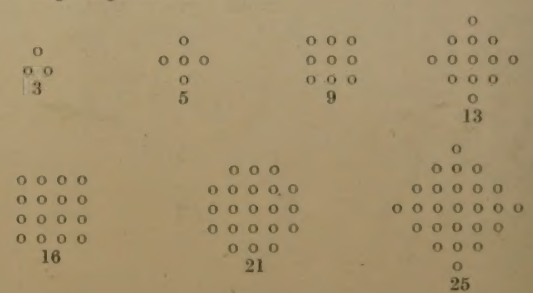
The possible variations of procedure which the system permits may be briefly considered.

Number of trees in the planting unit

Since it would clearly be economically disadvantageous that use of the new system should require a greater number of plants initially per hectare than the orthodox system, it is useful to begin by assuming that no more plants per hectare should be used than under the orthodox system. A widely accepted maximum spacing for Scots pine is probably one of 1.25 m. × 1.25 m., and for the faster-growing conifers one of 2 m. × 2 m. These distances correspond to 6,400 and 2,500 trees per hectare respectively. If we hope to find one tree from each planting unit in the final stand at maturity and if we expect to have the whole area completely covered by an unbroken canopy of mature trees, then our conception of the minimum number of mature trees necessary to ensure this must fix the maximum possible number of trees per planting unit. For example, if we think that the final stand on a certain site should contain at least 400 stems per hectare, then the maximum possible number of trees per group will be 16, or if we think that the final number of trees of Douglas fir must be not less than 200 per hectare, then the maximum possible number of trees per group will be 13.

Most of the experiments with the system so far carried out have made use of planting units with 13 plants, but there are already indications that with some species and on certain sites, this number is not adequate, at least with a uniform spacing within the group. It may be necessary, therefore, in order to secure the fullest advantages of the method to have not less than 21, 25 or even more trees per unit, which will, of course, mean unusually high costs of establishment.

If we assume for the moment that 25 individuals per unit or group is the maximum number desirable under all conditions, and, further, that the unit must have a symmetrical structure — although this is not necessarily so — it would appear that seven possible combinations of individuals are possible, namely groups with 3, 5, 9, 13, 16, 21 and 25, planted as shown in the following diagrams:



Groups of 3, 5, or 9 may be discarded, except where small groups of nurse species are to be introduced throughout a principal species, or possibly as recently suggested (4) when the method is to be used in establishing irregular stands as the risk of some trees other than the central one becoming dominant and forming the final stand is too great. Moreover, the groups are not large enough to ensure that light from outside the unit will be effectively cut off while the trees are young, so that branch development is unlikely to be much reduced in comparison with the orthodox planting methods. The unit with 16 trees may be discarded as it has no single central tree and the four inner trees are likely to compete too strongly with one another. This leaves the units with 13, 21 and 25 trees as the most likely ones for general use. To them may be added another symmetrical planting unit, composed of 37 trees, with three central rows of 7, two rows of 5 and two rows of 3, which may have its uses with certain species under certain conditions.

It will be seen that if symmetrical groups are to be stipulated then the shape of each planting unit is fixed by the number of trees in it. If the spacing within the unit is not the same in both directions, the shapes may be distorted and become elongated in one direction or another.

Composition of the planting unit

In composition, the planting units may either be pure consisting of one species only, or mixed consisting of two or more species. When the species are to be mixed within the groups themselves there is a variety of ways in which the species may be combined. Experience so far has shown, however, that intimate mixtures of this nature are going to be very difficult to handle, at least when there are few trees per unit and spacing within the unit is short.

Among the number of possible combinations of two species in mixture, the following are suggested with 21-tree and 25-tree groups:

```
  x x x          x o x          x x x
 x o o o x      x o o o x      x x o x x
 x o o o x      o o o o o      x o o o x
 x o o o x      x o o o x      x x o x x
  x x x          x o x          x x x

      x              x
    x x x          x o x
  x o o o x      x o x o x
x x o o o x x  x o x o x o x
  x o o o x      x o x o x
    x x x          x o x
      x              x
```

How and when these various forms of mixtures might be applied opens a wide field for experimentation. Much will depend upon the relative rates of growth of the two species, on the site and on the functions which the species are expected to perform. The use of outer rows of soil-improving species or of species which will follow up after and clean the stems of the principal species should be possible. It is particularly desirable to ensure that the slower-growing species on a given site is not placed in the interior of units. The use of spreading trees on the outside of units will accelerate the covering over of the inter-unit spaces.

Spacing between individuals within the planting units

Unless serious disadvantages can be shown, it is clearly desirable from the point of view of ease and cheapness of planting that the spacing of the trees forming a planting unit should be uniform throughout the unit.

Further, it is clear that the spacing between planting unit centers and the number of trees in the longest row across the unit must determine the maximum possible spacing within the unit. For example, if the spacing between group centers is 5 m, as there are four spaces of 1 m. in the center row of a 13-tree group planted at a spacing of 1 m. × 1 m. within the group, the interval between the outermost trees of two adjacent groups is 1 m, and to increase the spacing within groups will cause an overlap of the groups. In this case, then, we are restricted to using spacings within units of 1 m. or less.

The shortest practicable spacing within the group is probably one of 30 cm. × 30 cm., but some intermediate length will normally be better, say 50 cm. × 50 cm. or 75 cm. × 75 cm. Spacings of 1 m. × 1 m. and over will not, under normal European conditions and with the common European species, ensure the satisfactory killing of the lower side-branches and the clean boles which it is one of the main objects of the method to achieve. With fast-growing trees, the above spacings can be increased in proportion to the spacing between group centers.

However, where the initial rate of growth of the species in good sites is fast, it has been found that suppression of the inner circle of trees often takes place very quickly so that they soon cease to play any part in the competition necessary to remove the branches. The outer trees tend to become more dominant and the final stand thus tends to become composed of coarse-branched stems. It is now proposed, therefore, (3) to vary the spacing within the units in such a way as to give the inner trees a better chance of survival while leaving the competition amongst the outer trees intense. The suggested unit structure for groups of 13, 21 and 25 trees is as follows:

```
      o                o   o   o              o
    o ö o            o o   ö   ö o          o ö o
  o o ö   ö   ö o  o o ö   ö   ö o        o o ö   o o
    o ö o            o ö   ö   ö o      o o o ö   ö o o o
      o                o   o   o        o o   o   o o
                                          o ö o
                                            o
        13               21               25
```

The symbol "ö" indicates those trees from which at least one clean-boled dominant would be expected for the mature stand. The two spacings used in these planting units might be 75 cm. for the shorter and 1 m. for the longer, or 1 m. for the shorter and 1.25 m. for the longer, and so on.

So far, no experiments have been planted with this form of unit-structure, which will make rather higher demands upon the intelligence of the workers when planting. It may be said here, however, that no difficulty has been experienced in getting workers to plant by the new system, provided the plants are taken to

the area in bundles of 13, 21, 25, etc. All that the worker has to do is to locate the unit center, which he can do with a light stake and he then distributes his bundle around the stake in the manner required. Needless to say, in normal forest practice, absolute accuracy of spacing and shape and position of group are not essential.

In general, the spacing within the group will vary to some slight extent with the species, the site and expected rate of growth and the composition of the group, but it will make planting easier if such variation is kept to a minimum. The greater the number of trees in the planting unit, the shorter the spacings within the unit can be; competition will be keener but there is a better chance for one or several clean-stemmed dominants to develop than is the case in units of smaller numbers. In the trials made so far the commonest spacing has been one of 2 ft. × 2 ft. (60 cm. × 60 cm.) but spacings of 3 ft. (90 cm.) and of 1½ ft. (45 cm.) have sometimes been employed, all in relation to spacings between unit centers of 12, 15, 18 or 21 ft. (3.6, 4.5, 5.4 and 6.3 m.).

Spacing between the planting units

There are two things which require to be taken into account in determining the spacing between the planting units, namely, that the number of trees to be planted per hectare should not exceed the number used in orthodox regular spacing, and the number of mature trees expected per hectare when the stand reaches maturity. If it is stipulated that the same number of trees is to be used per hectare as with present planting methods, then with a group having a fixed number of trees, 13, 21, 25, etc., spacing between unit centers will depend directly upon the number of trees per hectare allowed. Table 1. shows this relationship.

If, on the other hand, it is stipulated that there must be at least 250 mature trees per hectare, which is equivalent to a spacing between unit centers of about 6.3 meters, then the number of plants required to give 250 21-tree or 25-tree units per hectare will exceed the number required with an orthodox spacing of 1.5 × 1.5 m.: it will be almost the same number in the case of 25-tree groups as that required with an orthodox spacing of 1.25 × 1.25 m.

The range of spacings between unit centres allowable will in general be found to run from 4 m. × 4 m. to 7 m. × 7 m., corresponding to 625 units and 204 units per hectare respectively.

The actual extent of ground left unplanted between the planting units depends not only on the spacing between the unit centers, but also on the spacing between the individuals within the units. The wider this spacing is, the smaller is the unplanted area between the groups.

Table 2 demonstrates what the unplanted intervals between the outer trees of adjacent units (Y), and what the unplanted areas of ground enclosed by four adjacent units would be at different spacings between unit centers and at different spacings within the units (B). This is shown in greater detail for 13-tree planting units, with which the inter-unit areas are octagonal in shape. The area enclosed by the bases of the exterior trees of each unit is also given for comparison (A).

The last column shows what proportion of the ground is not covered by trees in relation to the area which is, at the time of planting. As the trees grow, however, and develop their side-branches, the ratios given will gradually be reduced, until ultimately the whole ground surface becomes over-shaded with foliage. The period which will lapse before this occurs will depend on several factors, but mainly on the species and the rate of growth.

These unplanted inter-unit spaces are extremely important and are an essential feature of the method. They offer certain important advantages over the ordinary orthodox regular planting method.

Mixing of pure planting units

As already mentioned, the system lends itself to the mixed planting of species in two ways. The mixing of the species within the planting unit itself has already been briefly touched upon, but the species may also

TABLE 1. — RELATIONSHIP BETWEEN ORTHODOX PLANTING DISTANCES AND UNIT-SPACINGS

Planting-distance by orthodox systems (cm.)	Stems per hectare	New system, no. of groups per ha.	Spacing between unit centers (approx.) (m.)
13-tree unit			
75 × 75	17 778	1 368	2.8 × 2.8
100 × 100	10 000	769	3.6 × 3.6
125 × 125	6 400	492	4.5 × 4.5
150 × 150	4 444	342	5.5 × 5.5
21-tree unit			
75 × 75	17 778	846	3.5 × 3.5
100 × 100	10 000	476	4.6 × 4.6
125 × 125	6 400	305	5.7 × 5.7
150 × 150	4 444	212	6.8 × 6.8
25-tree unit			
75 × 75	17 778	711	3.7 × 3.7
100 × 100	10 000	400	5.0 × 5.0
125 × 125	6 400	256	6.2 × 6.2
150 × 150	4 444	178	7.5 × 7.5

Table 2. — Intervals and Unplanted Areas between Planting Units at various Unit Spacings (X) and Planting Distances within the Units (Z)

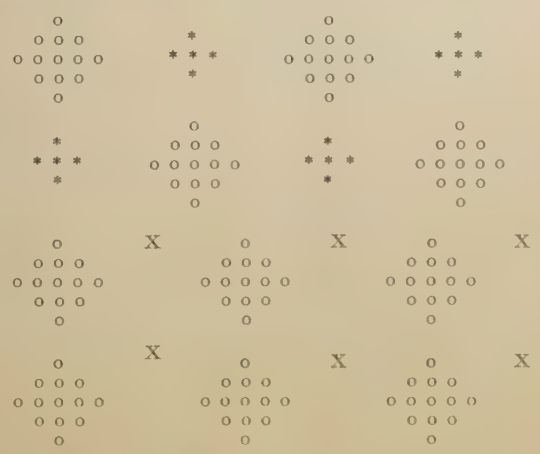
Spacings between unit centers (X) (m.)	No. of units per ha.	No. of trees per ha.	Planting distance within units (Z) (cm.)	Area covered by each unit (A) (m.²)	Interval between outside trees of units (Y) (m.)	Inter-unit area not covered by trees (B) (m.²)	Ratio B/A
13-tree unit, old style							
4 × 4	625	8 125	50 × 50	2.0	2	14.0	7.0
,,	,,	,,	75 × 75	4.5	1	11.5	2.6
,,	,,	,,	100 × 100	8.0	0	8.0	1.0
5 × 5	400	[1]5 200	75 × 75	4.5	2	20.5	4.0
,,	,,	,,	100 × 100	8.0	1	17.0	2.2
,,	,,	,,	125 × 125	12.5	0	12.5	1.0
6 × 6	278	[1]3 614	75 × 75	4.5	3	31.5	7.0
,,	,,	,,	100 × 100	8.0	2	28.0	3.5
,,	,,	,,	125 × 125	12.5	1	23.5	1.9
7 × 7	204	[1]2 652	75 × 75	4.5	4	44.5	9.9
,,	,,	,,	100 × 100	8.0	3	41.0	5.2
,,	,,	,,	125 × 125	12.5	2	36.5	2.9
,,	,,	,,	150 × 150	18.0	1	31.0	1.7
21-tree unit, new style							
6 × 6	278	5 838	100 × 75	11.1	2.5	24.9	2.2
7 × 7	204	4 284	,,	11.1	3.5	37.9	3.4
25-tree unit, new style							
7 × 7	204	4 284	,,	15.6	2.0	33.6	2.2
37-tree unit							
7 × 7	204	7 548	75 × 75	15.8	2.5	33.2	2.1

[1]) Due to overlap of units there should be reductions in the number of trees required by about 500, 360 and 220 per ha. respectively in these three cases.

be planted in pure groups and mixed by groups, all trees in some groups being of one species and all those in others of another species. Such a mixture may be regular after some definite pattern, as is usually the case when a single tree is the planting unit, or it may be irregular and in such a way as to ensure that the two species are distributed to make the best use of uneven ground and varying locality conditions. For example, units of spruce will be placed in wet hollows and units of pine on dry ridges, or the mixture of units may be done regularly simply to ensure that trees of both species will occur in the final stand.

A further useful possibility, however, is that of being able to mix units of different structure, when the function of the two species to be mixed differs; for example, when one species is included merely as a nurse for a more valuable main species. It is very seldom that a stem-by-stem mixture of two species by the orthodox regular planting method is a success. The two species seldom grow at the same speed on all localities and so one has to be specially helped against the other. The general tendency nowadays is to mix species either by lines of three rows each or of five rows each or by small pure groups, in such a way that no part of the ground is unplanted. A favourite group size or planting unit is one of nine trees.

The proposed new method of planting dense groups, widely spaced, lends itself very well to mixing a main species with a nurse species, and offers possibilities of reducing the costs of establishment. This reduction can be achieved by mixing small units of the nurse species with normal units of the main species. These small units may consist of 5, 3 or even of single trees, thus:



A further advantage of the method in the growth of mixtures is that the faster-growing nurse-tree units can be removed after they have fulfilled their purpose and can be replaced by the main species or by another secondary species to act as a soil-maintainer or a follower. For example, European larch grown as a nurse for oak might be removed and replaced by beech, leaving a mixed oak-beech stand with the oak well ahead.

Fig. 1. *A single 13-tree planting-unit of oak, ten years old, in Callan forest, County Kilkenny, Ireland, in which eight straight-stemmed, branch-free trees are still left alive to compete with one another. In the inter-unit spaces there are masses of dense weedy growth which need no attention and will soon be suppressed by the oaks.*

Fig. 3. *A 13-tree planting unit of slow-growing twenty-year old European larch high up on an exposed hill-side. It shows the effects of exposure and also how the tree at the inner corner on the sheltered side has a chance to develop symmetrically. Here the spacing between units is 4.5 m.*

Fig. 4. *A stand of European larch of exactly the same structure as that in Fig. 3, but it is of faster growth although of the same age and on an even steeper slope. This stand is now ready for thinning and the spaces available for extraction of material can be seen. Nevertheless, the canopy has completely closed and there are many finely-branched straight stems available for the future stand.*

Fig. 2. *The margin of a stand of Spanish Chestnut, grown as groups of thirteen trees spaced 60 cm. apart within the groups. The spacing between the group centers was 4.5 m. and there were originally single nurses of European larch in the group inter-spaces. The canopy has closed over.*

A further illustration of the flexibility of the method is that it results in a stable stand structure, from which whole units can, if desired, be removed after they have reached small pole and utilizable size and can be replaced with whole units of a new species, which may be a tender shade-bearer requiring shelter which the remaining units supply. This procedure is now being tested.

The method of planting by dense groups, widely spaced, has been criticised on the grounds that it is a difficult method to apply in practice. In fact, however, this has not proved to be so, although it certainly requires a little more thought and supervision than the simpler orthodox method. The main difference is that the planter has to locate the unit center in addition to the location of each tree. This disadvantage is more than offset in subsequent beeting and liberating operations, for it is easier to locate a group than single trees.

Some Examples

When the new system was first mooted, it was found very difficult to convey any clear impression of what a plantation established in the manner suggested would look like. In the past 25 years, however, many of the trial plantations have developed sufficiently to provide useful illustrations of the general appearance of planting units and stands in the early stages. It is stressed that it will still be many years before the final form of stand can be known.

A selection of photographs taken in existing stands has been made to bring out certain points and to convey to those who have not seen actual examples what such plantations look like before the thinning stage.

In all cases shown, the planting distance within the units was approximately 60 cm. by 60 cm.

Probable Advantages and Disadvantages of the Method

It will not be possible to discover the full advantages and disadvantages of the proposed new system of planting by means of dense groups, widely spaced, until the plantations established by this procedure reach maturity, and until the full scope of the possible combinations and modifications has been fully tested out over as wide a range as possible. This is a very long-term project.

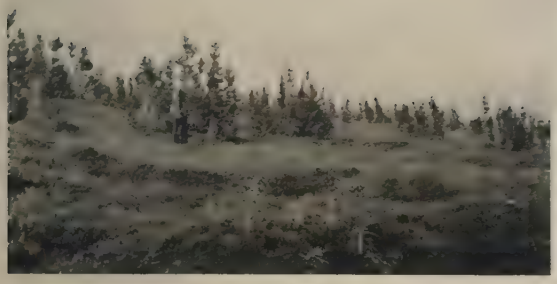


FIG. 5. *A twenty-year old stand of groups of pure Contorta pine on dry ridges and pure Sitka spruce in wet hollows of very poor ground. The groups are of 13 trees spaced 60 cm. apart within the groups, whose centers are about 4.3 m. apart. A shorter interval between group centers is desirable on this poor, exposed site but it is possible to carry out increased drainage without weakening the stand.*

FIG. 6. *A stand of Scots pine from the same experimental area as the stand in Fig. 5. The groups were planted on specially prepared patches and the figure shows how the vegetation has been altered in comparison with the inter-unit spaces. Here there is plenty of room to introduce new groups without disturbing or weakening the existing stand.*

Meantime, however, it has already given certain indications of likely advantages and disadvantages. A few of these may be said to be definitely proved already, others can only be surmised or anticipated. They may be considered under these two categories.

Proved advantages

1. The type of stand-structure produced greatly increases freedom of movement and action throughout the stand, so that inspection, tending, extraction, drainage, soil cultivation and all operations subsequent to planting are greatly facilitated.
2. The type of stand-structure produced is of particular value on steep and very steep slopes, for it not only allows ease of extraction of early thinnings without damage to the retained best stems, but also allows the survival of a higher proportion of trees with symmetrical crowns in the mature stand.
3. The type of stand-structure produced is in the early years more stable and stronger than that produced by close or moderately close normal spacing and this allows greater flexibility of treatment, for it permits altering or improving the composition and increasing the irregularity of the stand, should this be desired — in protection forests and stands, for example — without undue risk of storm damage.
4. Where intensive methods of soil preparation and of manuring are needed to give trees a boost to carry them over the first difficult years on poor sites, a satisfactorily established stand can be ensured by concentrating the costly special operations only to the small areas on which the dense groups are to be planted. This may mean a considerable reduction in costs of establishment.
5. Similarly, in areas of short scrub which is expensive to clear, a satisfactory stand can be obtained on certain sites by confining the scrub-cutting to small-spaced gaps, into which the new species can be introduced in dense groups.

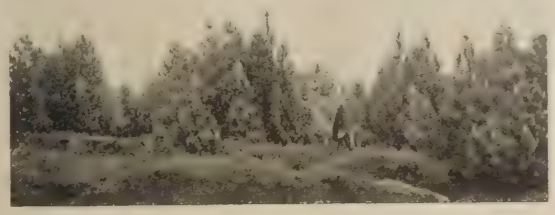


FIG. 7. *A nineteen-yeart old shelterbel of mountain pine and other hardy species, planted in pure groups at a spacing between trees in the group of 60 cm. and between group centers of 4.5 m. The mountain pine lends itself very well to this planting method and makes a valuable marginal tree.*

FIG. 8. *A twenty-one-year old plantation of mixed groups of Scots and Contorta pines in the foreground with mixed groups of Scots pine and Sitka spruce on the right, the species being varied to suit the variations of site. The inter-unit spacing is one of 5.5 m. and the canopy is just beginning to close over. Its general outline and character are well seen.*

FIG. 9. *Part of another plantation of Contorta pine, twenty years old, on better ground but having the same structure as that in Fig. 8. The canopy has not yet closed at the spacing between units of 5.5 m., but the groups have a very promising form.*

FIG. 10. *A twenty-one-year stand of pure Contorta pine, in which the 13-tree units are spaced at 4.5 m. between centers. Here it may be seen that the canopy has already closed and one unit has been opened up to show that there is in it one straight finely-branched dominant tree. More coarsely-branched outside trees are also visible, but the stand is now ready for thinning and these should gradually be removed.*

FIG. 11. *Part of a plantation consisting of pure units of Japanese larch, spaced at 5.5 m. between group-centers on heath-land. At twenty years of age the canopy is about to close and the stand is almost ready for thinning. In the foreground is a younger plantation of Scots pine planted by the orthodox regular method.*

FIG. 12. *The exterior of a plantation of mixed wedge-shaped groups each containing 47 plants. These units consist of a core of sitka spruce with a fringe of Contorta pine and are growing on very poor peat. The spacing within the unit is rather less than 60 cm. and that between group-centers is irregular, so that the groups join up in one direction to form a continuous band and are spaced about 5 m. apart in the other. They actually lie along the drains. The canopy has not yet closed over the inter-unit spaces but each group contains a number of clena-stemmed straight spruces andt heir height-growth is still good.*

Probable advantages, not yet proved

1. It seems to offer distinct prospects of the production of straight, clean, branch-free stems, pruned naturally, at a cost no higher than in methods employing normal average spacings and with less risk of producing unstable stands.
2. The type of stand-structure allows greater choice of élite stems for the mature stand. so chosen that they completely cover the whole area.
3. The system is well adapted for use in planting mixtures, especially if the species are planted pure in the groups. It can be modified so as to make the best use of nurse species without harm to the main species and can be used to bring in secondary species or underwood in such a way that the latter are not too greatly subject to over-head shade.
4. The stand-structure produced probably allows greater delay in the making of thinning without risk to the stability of the stand.
5. Under certain conditions, snow damage at high altitudes may be reduced.
6. The stand-structure produced seems to be specially well-suited for the formation of shelter-belts and protective margins to forest areas. In this connection attention may be drawn to the recently advertised Russian method of "nest" plantings and sowings, recommended for shelter-belt planting, which is essentially similar.

Probable disadvantages

1. In the early years there is probably a greater fire-risk in plantations of this form, because of the greater amount, for a time, of withered herbage in the unplanted inter-spaces.
2. There is a risk, under certain locality conditions, of the outer trees of the units developing more vigorously than the inner and becoming dominant. As these will normally be more coarsely-branched than trees planted at normal average spacings, a stand with inferior timber will result.

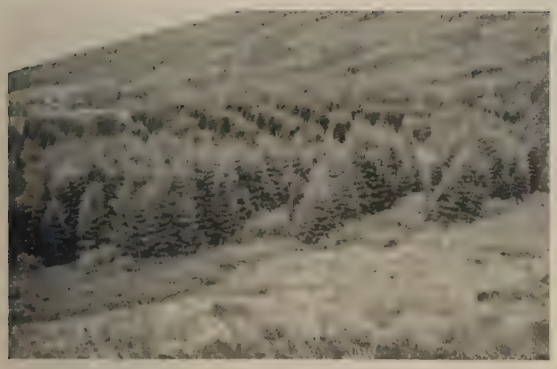


FIG. 13. *A more distant view of another part of the same area shown in Fig. 12. This provides an illustration of the appearance of a stand grown in dense groups widely-spaced, a measure of the height of the trees being given by the fence-posts in the central foreground. The invasion of birch into some of the inter-unit areas is just visible. The stand is now ready for thinning to ensure at least one stable stem per unit.*

FIG. 14. *Part of a poor area plowed in alternate strips upon which adpressed planting-units of 13 trees were twenty-two years ago. The spacing within the units was 30 cm. across the plowed strip and 60 cm. along it; the units linked up along the strip and were spaced about 6 m. between centers at right-angles to it. They thus now form continuous serrated bands.*

This tendency can, however, probably be controlled by suitable planting unit structure and by proper thinning technique.

3. To get satisfactory clean timber it may, under certain circumstances, be necessary to plant more trees per hectare than by an orthodox technique using wide spacings, and this will add to the costs of establishment. This extra cost may or may not be balanced by improved timber value *plus* the other advantages of the new method. That remains to be studied.

CONCLUSION

The proposed method of establishing plantations by means of dense groups or planting units of various composition and structure, widely spaced between their centers, represents a radical break-away from the normal, accepted practice of planting the individual trees at regular spacings all over the area. It appears to offer very important advantages over the orthodox method, in particular from the fact that an essential feature of the method is to leave at least half of the planting area unplanted between the groups.

While trials of the system to date only touch the merest fringe of the possible variations, they are already promising and it is thought very desirable that more wide-spaced experimentation should be carried out on the same lines. The object of this article is to draw wider attention to what is, after all, a very simple idea, in the hope that world-wide trials of the system may be initiated and that positive results will be obtained which will lead to improvements in silvicultural technique concerned with artificial regeneration and afforestation. While the writer is unlikely to see the final outcome of the first trials, he would wish to express his thanks to the State Forest Services of Great Britain and Ireland for enabling him to initiate these trials and for allowing him to study their later development and to report thereon.

FIG. 15. *Part of a 23-year-old stand at an elevation of about 350 m. in full exposure. Various species have been planted here in pure groups, the species being mixed by groups. Within the units the spacing is 30 cm. by 30 cm. dnd 5.5 m. average between group-centers but the number of trees varies. The sheltering effect of the taller Contorta pine groups to leeward is appreciable. Also, in a severe gale when a complete group of them over, it did not affect the stability of the remaining units. This figure is a good illustration of one of the most important uses of the method of planting by dense groups, widely spaced.*

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The Field Identification of Eucalypts

Use of a Card Sorting System

by Norman Hall, Division of Forest Resources and Timber Production, and R. D. Johnston, Division of Research, both of the Forestry and Timber Bureau, Canberra, Australia

The conventional aid to the identification of species of plants is a dichotomous key. Such keys are typically designed for use within a restricted geographical area. Keys for genera and families are commonly of use in a wider area and may be of general application. The design of keys to separate a limited number of species within one genus does not usually present serious problems. Greater difficulty may occur, however, when trying to separate a large number of species within one genus, especially if the genus does not fall into clearcut sections. The genus *Eucalyptus* presents major difficulties in this respect as it is not possible to divide this large genus satisfactorily other than by using an antherial classification.

The only key which covers all eucalypts is that of Blakely (2). This depends upon an antherial classification and, while of value to the systematist, fails to serve the purpose of the non-specialist. There are many dichotomous keys which deal with the eucalypts of a restricted area, e.g. state or portion of a state. However, even these keys, when dealing with a large number of species, frequently use anthers as a criterion for separation of species groups. Some of these keys, when not dependent upon antherial classification, are of considerable local value and admirably fulfil the purpose for which they were designed. The need for a different type of key for the genus as an entity has been in evidence for a number of years. Kessell and Gardner (9) in 1924 developed a numerical coding system for use in Western Australia, and Hall (7) adapted the method in 1934 for eucalypts in New Zealand. Like the dichotomous keys the numerical coding system was of use in restricted areas but was too cumbersome for general application. Jacobs (8) in 1935 adopted the principle of illustrating fruits and leaves to aid in identification.

The possibilities of a card sorting system for the identification of plants have engaged the attention of foresters and forest botanists for some time. Dunkley (6) wrote in 1939 "The perforated card key system described by S. H. Clarke (3) has proved so successful for the identification of timbers that it was thought worthwhile to test this system for botanical determinations." A key was prepared for Uganda and another for British Honduras. Walker (11) in 1948 proposed a key for Malaya to cover 81 characters, including territory, habitat, form, bark appearance and gross leaf characters.

Use of the system

The use of card sorting systems in the field of timber identification is by no means new. Pioneer work in this connection, done by S. H. Clarke in England, was followed up in Australia by the Forest Products Division of CSIRO, and goes back to 1936 (5). During World War II, over 60,000 cards for timber identification were prepared for use in New Guinea and the islands to the north.

The first application, so far as the authors are aware, of card sorting as a method of botanical identification of species within a single genus, was that of R. H. Anderson, Government Botanist of New South Wales, who, about 1940, designed a card system for use in the identification of herbarium specimens of *Eucalyptus*.

The advantages of developing a card sorting key for the field-identification of eucalypts have been recognized by the authors for some time, and, in 1949, a prototype card was designed. After various trials the design of the card was amended and they are now in a position to present a system which appears to be of practical value for forest workers.

A card sorting system has several distinct advantages, as well as some disadvantages, compared with a dichotomous key. Amongst the advantages are:

1. complete botanical material is not necessary. Dichotomous keys frequently break down on this point. There is little need to stress the fact that it is the exception rather than the rule to be able to gather flowers, buds and fruits at the same time;
2. it is possible to sort in any order. Most eucalypts have one or two distinctive features and full advantage can be taken of this in a card sorting system;
3. it is suitable for the use of the non-botanist;
4. additional species can be added without involving any basic change in the key.

Amongst the disadvantages are:

1. the key is relatively expensive to produce;
2. it is bulky.

The object of a card sorting system such as this is not to provide unequivocal identification of a specimen, but rather to enable the user to reduce the possibility of an unknown being one of a hundred or more species to one of a few. It then becomes practicable to check details against botanical descriptions.

The degree of sorting will depend on the species treated. Distinctive species such as *E. globulus* may be sorted out to a single card, whereas in certain cases the limits of sorting will produce a group of closely related species which even specialists in eucalypts cannot readily separate. Some of the species in Blakely's

(continued on page 68)

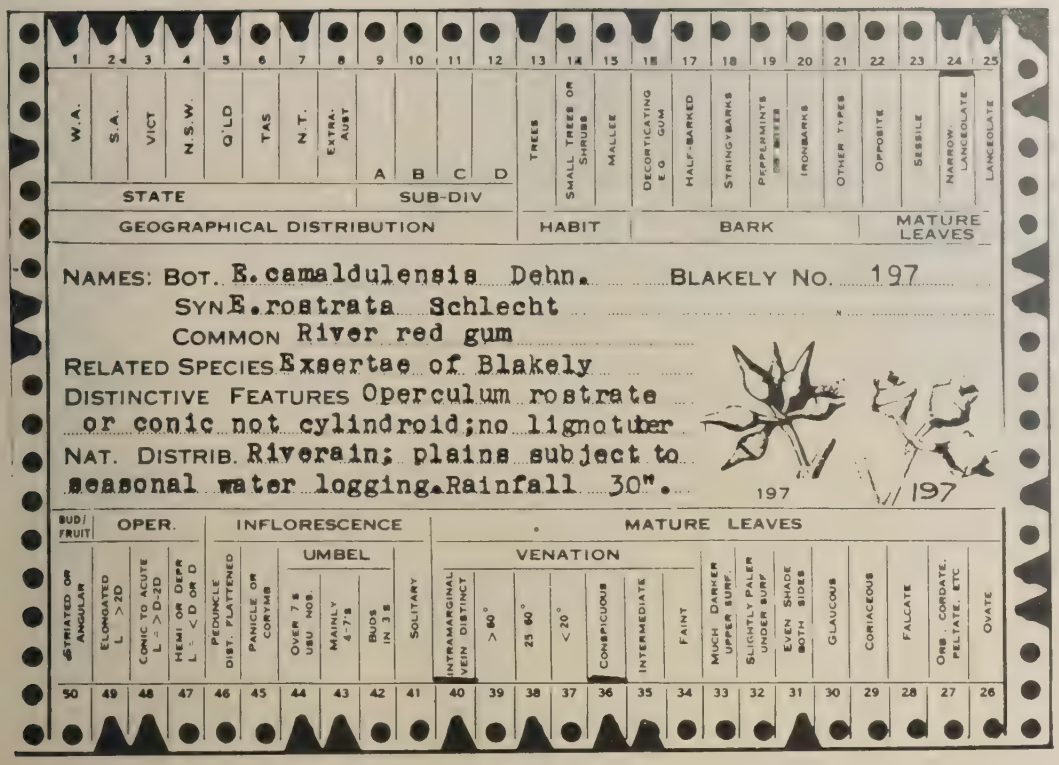
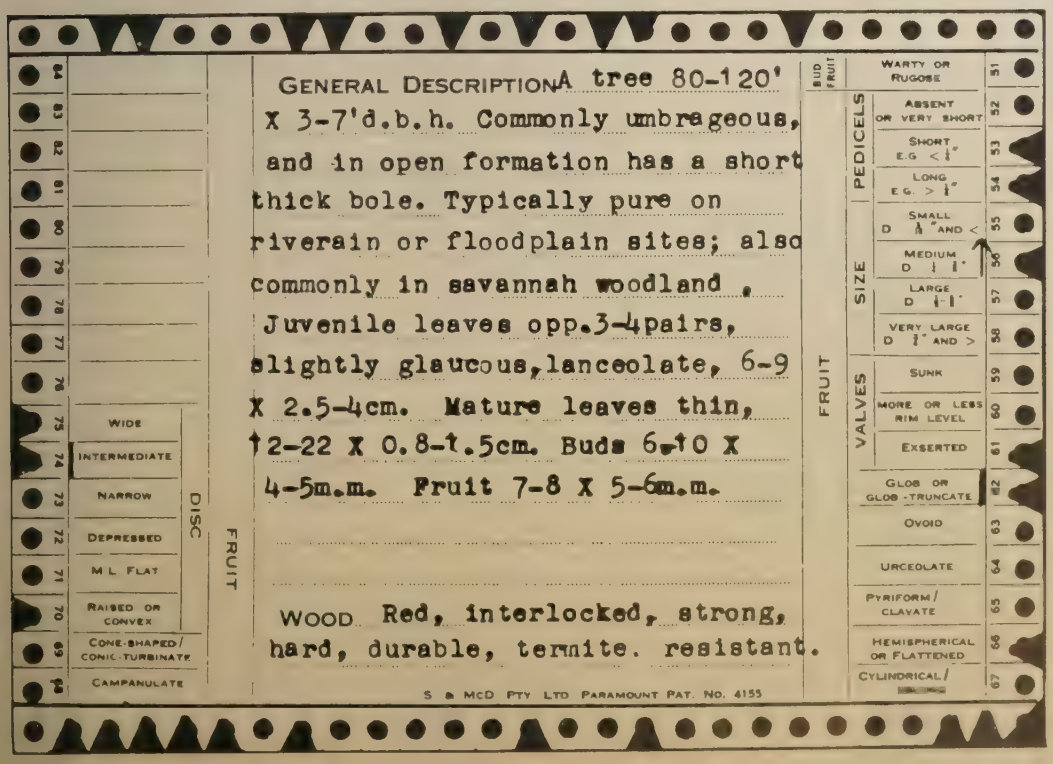


FIG. 1 and 2. *Both sides of a typical card used in the system advocated by the writers of this article.*



NOTES ON A CARD SORTING SYSTEM FOR THE FIELD INVESTIGATION OF EUCALYPTS

Introduction

1. *This is not a eucalypt classification system. It is an aid to the determination of species by workers who are unfamiliar with the species of a given area.*
2. *The system is intended for the use of workers with some knowledge of botany but who are not experts on eucalypts.*
3. *The nomenclature is based on Blakely (1934). Species which have been published since then are also included. Where present day botanists differ from Blakely their views, on nomenclature, where known, have been added.*

Basis of coding

It is emphasized that the coding, which has been based on original descriptions and extensive examination of herbarium material, has been made as inclusive as possible so that all normal variations will be included.

Users of the key should make themselves familiar with the definitions upon which the coping has been based.

Physical sorting of the cards

When a group of cards are to be sorted they should be placed together, taking care that all are correctly orientated. This is aided by the top right hand corner being clipped. The most suitable tool for sorting is a stout knitting needle. To sort for any feature insert the needle through the holes for that number and raise the cards off the table. Shake gently and the cards which have been clipped for that feature will drop. Check the cards that remain on the needle to ensure that all clipped cards have dropped. Continue sorting with the cards which have dropped.

The sorting of a species

The beginner should note down the features which characterize an unknown species, separating distinctive features which should be used first in sorting from those which are of less value and mainly of use in confirmation. Sort in order of the distinctiveness of the features present and not necessarily in numerical order. The user should not try to sort down to the last card, unless there are strong features which enable this to be done, e.g., as with E. globulus *in Vict. or Tas. It is usually wiser to sort to a few cards and then examine these by hand, noting the illustrations and any comments on the species. Confirmation of the species should then be sought from Blakely or from any state reference book which may be available.*

Selection of features for use in sorting

The following is a summary of notes on the group of features used in sorting. Illustrations of features 24-28, 37-39 and 47-75 are given on pages 2-4.

Geographical distribution, 1-12. Check that species is native to a state and not introduced. Species commonly met include E. fleifolia, cladocalyx *and* citriodora.

Habit, 13-15. Species normally found as trees may be stunted in habit on very unfavorable sites.

Bark, 16-21. It there is any doubt as to bark type omit from the sorting. Do not sort mallees on bark.

Mature leaves, 22-40. Only use typical leaves from crown. Features which are of high selective value in sorting include 22-,24 27, 30, 33, 37 and 39. Other numbers are of little value in initial sorting but are of value in confirmation.

Inflorescence, 41-46. Check that solitary or few fruited umbels are not due to non-development of the buds. Look at number of buds. F. 41-42 are of most value.

Operculum, 47-49. Check that operculi are mature. F. 49 is highly selective. F. 48 less so.

Markings on buds and/or fruits, 50-51. Only sort on good examples. Check that markings are not due to insects.

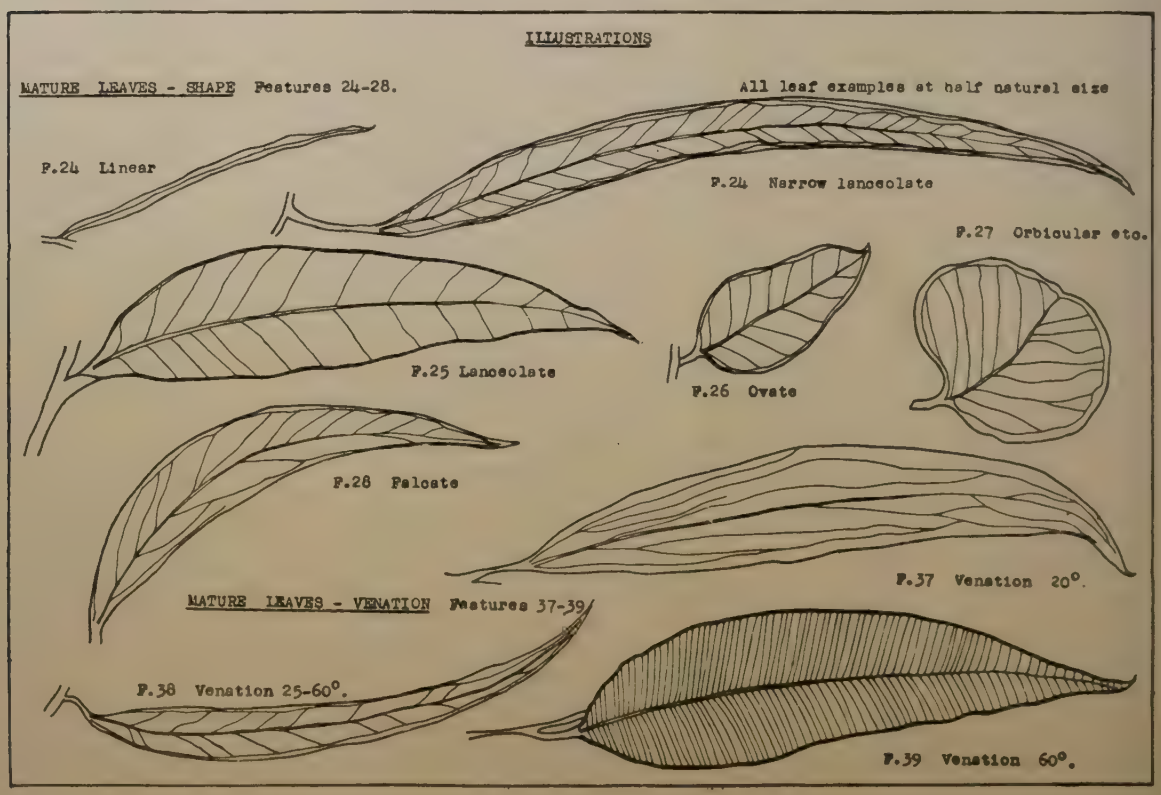
Fruit, pedicels, 52-54. F. 51 is selective as also is 54; only use the latter in well developed examples.

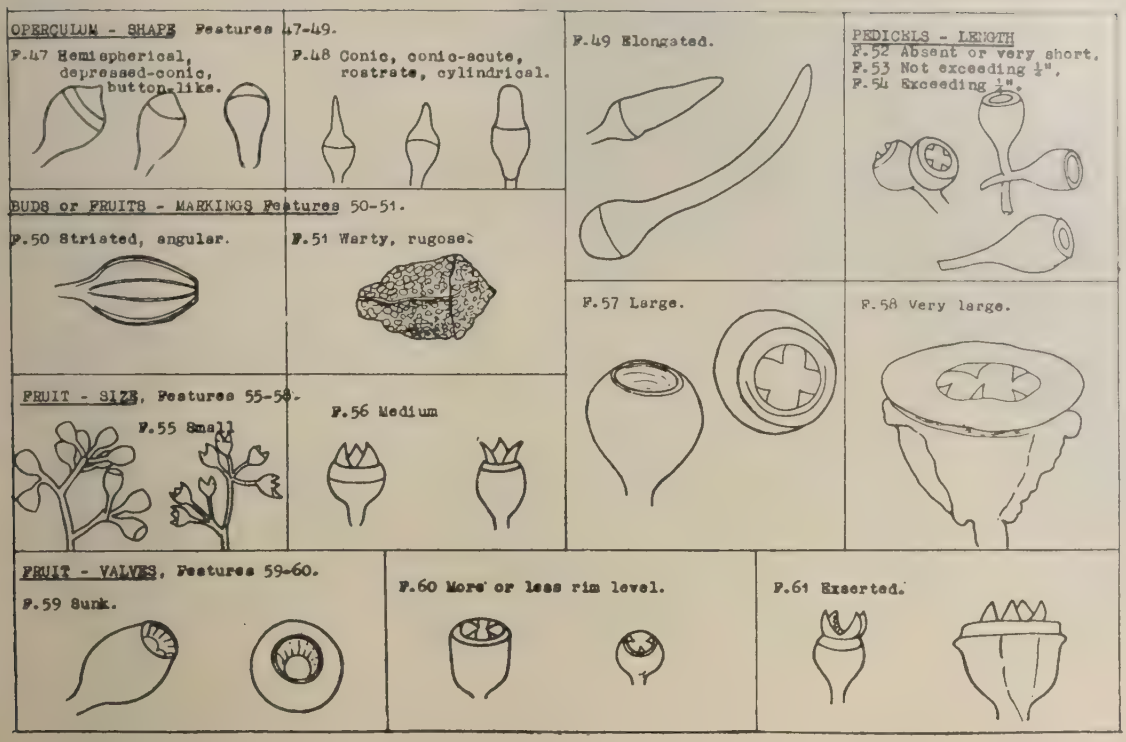
Fruit, size, 55-58. Base on representative capsules. F. 58 is very selective, to a less extent 55 and 57.

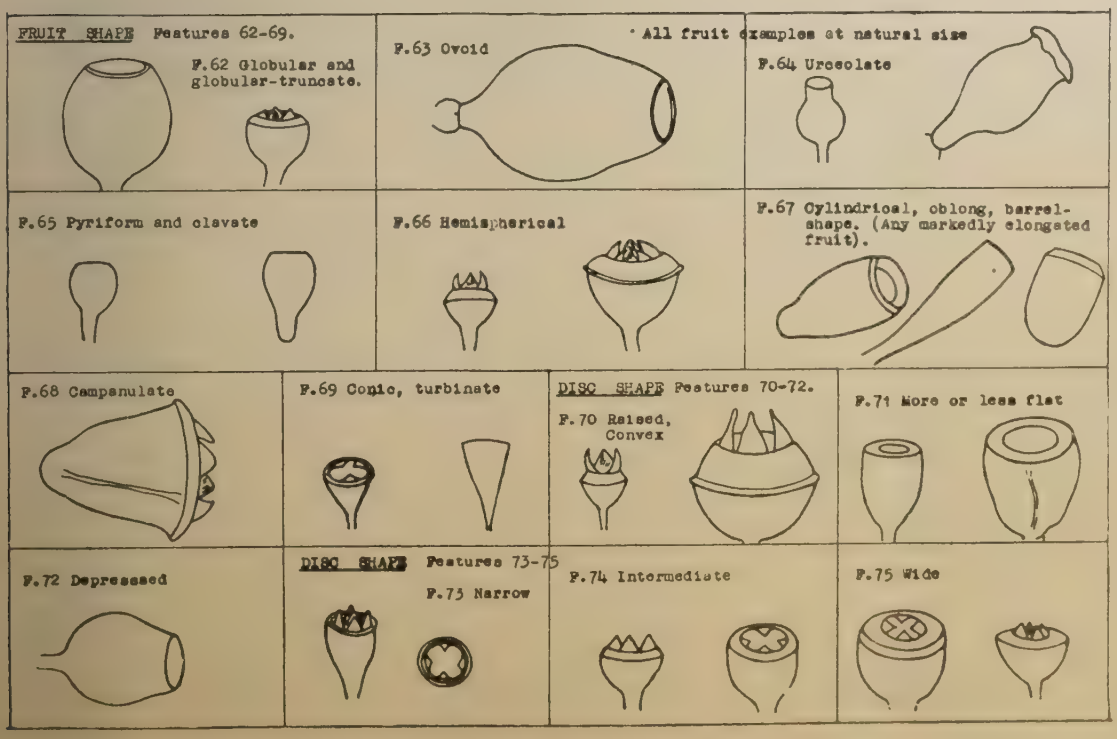
Fruit, valves, 59-61. Typical examples of F. 59 and 61 are always of value in sorting but marginal cases, especially 60/61 should be omitted from initial sorting.

Fruit, shape, 62-69. Most species show a range in shape so that it is the exception for any one species to be coded on one shape only. Some species do not fit exactly into any of the eight shape groups given but must be sorted on closest shapes. In most cases do not sort on shape until the final stages, unless the shape is quite distinctive, e.g., F. 64 for E. urnigers, *etc.*

Fruit, disc, 70-75. In most cases the disc is readily determined and is generally of considerable value in sorting. Only in the case of F. 73, narrow discs, is special care needed, since these discs - as seen in many mallees and boxes - may show F. 70, 71 or 72 in the same species. Well developed examples of 70 or 72 with 74 or 75 are always strong features upon which to sort.




OPERCULUM - SHAPE Features 47-49.
F.47 Hemispherical, depressed-conic, button-like.
F.48 Conic, conic-acute, rostrate, cylindrical.
F.49 Elongated.
PEDICELS - LENGTH
F.52 Absent or very short.
F.53 Not exceeding ½".
F.54 Exceeding ½".
BUDS or FRUITS - MARKINGS Features 50-51.
F.50 Striated, angular.
F.51 Warty, rugose.
F.57 Large.
F.58 Very large.
FRUIT - SIZE, Features 55-58.
F.55 Small
F.56 Medium
FRUIT - VALVES, Features 59-60.
F.59 Sunk.
F.60 More or less rim level.
F.61 Exserted.


FRUIT SHAPE Features 62-69.
F.62 Globular and globular-truncate.
F.63 Ovoid
All fruit examples at natural size
F.64 Urceolate
F.65 Pyriform and clavate
F.66 Hemispherical
F.67 Cylindrical, oblong, barrel-shape. (Any markedly elongated fruit).
F.68 Campanulate
F.69 Conic, turbinate
DISC SHAPE Features 70-72.
F.70 Raised, Convex
F.71 More or less flat
F.72 Depressed
DISC SHAPE Features 73-75
F.73 Narrow
F.74 Intermediate
F.75 Wide

" white stringybark " group provide an excellent example of the latter condition.

It is desired to emphasize that the card sorting system does not in any way take the place of a flora. It is intended to act as an auxiliary to Blakely or any regional flora.

In the design of the card consideration was given to the following:

1. the unit should be of convenient size and easy to manipulate in the field. The card size selected by the authors is $4\frac{1}{2} \times 6$ in. (11×15 cm.);
2. the possible combination of features provided should be sufficient to cover the number of species in the genus;
3. the features selected should be such that a sufficient number would be readily available in the field at any one time;
4. all features used should be readily recognizable without optical aids;
5. features used should be relatively constant at a specific level;
6. sufficient alternatives should be provided in feature groups to ensure that:
   (*a*) specific differences can be distinguished;
   (*b*) normal variability can be covered;
   (*c*) intermediate forms between two extremes can be sorted direct. (Several card sorting keys show one less feature than the number of possible alternatives; the features omitted being sorted " by default. " Where, as in eucalypts, two alternatives out of three may be found in one species, then this system breaks down).

The features which were finally selected for coding are listed below:

A. Geographical distribution

State:	1.	Western Australia
	2.	South Australia
	3.	Victoria
	4.	New South Wales
	5.	Queensland
	6.	Tasmania
	7.	Northern Territory
	8.	Extra-Australia
Sub-divisions:	9.	
	10.	
	11.	
	12.	

(These are intended for geographical divisions within any one State and are hence not of application for a general set of cards. An example of geographical subdivision is that of western plains, western slopes, tablelands and coast for New South Wales).

B. Habit	13.	Trees
	14.	Small trees or shrubs
	15.	Mallees
C. Bark	16.	Decorticating
	17.	Half barked
	18.	Stringybarks
	19.	Peppermints and boxes
	20.	Ironbarks
	21.	Other types

D. Mature leaves

Phyllotaxis:	22.	Opposite
	23.	Sessile
Shape:	24.	Narrow lanceolate
	25.	Lanceolate
	26.	Ovate
	27.	Orbicular, cordate, including peltate, etc.
	28.	Falcate
Texture and color:	29.	Coriaceous
	30.	Glaucous
	31.	Even shade both sides
	32.	Slightly darker upper surface
	33.	Much darker upper surface
Venation: *Visibility of general network*	34.	Faint
	35.	Intermediate
	36.	Conspicuous
Angle:	37.	$< 25^{o}$
	38.	$25 - 60^{o}$
	39.	$> 60^{o}$
Intramarginal vein:	40.	Visible and separate from margin of leaf

E. Inflorescence

	41.	Solitary
	42.	Umbels – Buds in 3's
	43.	Umbels – Buds mainly 4 – 7's.
	44.	Umbels – Buds over 7's usually numerous
	45.	Panicle or corymb.
Peduncle:	46.	Peduncle distinctly flattened
Operculum:	47.	Hemispherical or depressed hemispherical $L = D$ or $< D$.
	48.	Conic to conic-acute $L > D$ to $= 2D$
	49.	Elongated. $L > 2D$
Markings on bud and/or fruits:	50.	Striated or angular
	51.	Warty or rugose
Pedicels:	52.	Absent or very short
	53.	Short, i.e. $< \frac{1}{4}$ in. (0.6 cm.)
	54.	Long, i.e. $> \frac{1}{4}$ in.

F. Fruit

Size:	55.	Small, $D < \frac{1}{4}$ in.
	56.	Medium, $D = \frac{1}{4}$ to $\frac{3}{8}$ in. (0.6 to (0.9 cm.)
	57.	Large, $D = \frac{1}{2}$ to $\frac{3}{8}$ in. (1.3 to 0.9 cm.)
	58.	Very large, $D = \frac{3}{4}$ in. and over
Valves:	59.	Sunk
	60.	More or less rim level
	61.	Exserted

Shape:	62.	Globular or globular-truncate
	63.	Ovoid
	64.	Urceolate
	65.	Pyriform or clavate
	66.	Hemispherical or flattened
	67.	Cylindrical or oblong
	68.	Campanulate
	69.	Cone-shaped or conic turbinate
Disc: position	70.	Raised
	71.	More or less flat (level)
	72.	Depressed
Width:	73.	Narrow
	74.	Intermediate
	75.	Wide.

(Numbers unallocated on the cards are 76-84).

The use of juvenile foliage as a feature for identification has been championed by some workers, and it is felt that an explanation of its absence from the coding features is called for. This feature was used in the prototype card, but it was found that it could not be used as a sorting feature for species of eucalypts since satisfactory descriptions did not exist for a large number of species. In addition, it should be pointed out that juvenile foliage does not commonly occur on mature trees. When juvenile foliage is only on young plants and cannot be positively associated with buds and fruits of mature trees, it is of restricted value in identification. In some localities of Australia one may find the cards for *E. dalrympleana*, *rubida* and *viminalis* sort out together. Notes on the front of the cards will readily separate *E. viminalis* from the other two species on the difference in juvenile foliage. The separation of the remaining two species is more difficult, especially for the novice.

Apart from the 75 features which have been coded, provision has been made for individual users of the system to incorporate special features if they so desire, in that nine spaces on the cards are not allocated. It is intended that additional information should be shown on the face of the card, where provision has been made for Blakely's number, botanical and common names, related species, features distinctive to the species and natural distribution.

Definitions of the features used and notes on the technique of sorting have been prepared, as an aid to users of the key. As far as possible the conventional botanical meanings of terms have been used but in some cases it has been necessary to use a modified interpretation of a term, e.g. a narrow lanceolate leaf has been arbitrarily defined as one in which the ratio of length to breadth of a typical mature leaf exceeds 10:1. Some of the terms used, especially those relating to shape of the fruit, are not so readily adapted to definition in words and a plate has been prepared to illustrate features 24-28, 37-39 and 47-75.

In the same manner in which wood anatomists found that photographs illustrating wood structure were needed on the wood sorting cards, it was found that illustrations of the fruits and buds on these cards were extremely helpful. These have been based on specimens figured by Maiden (10) and produced in a form suitable for use on the cards.

Preliminary coding was done from the descriptions in Blakely and reference made to post-Blakely publications. This was amplified by a careful examination of many thousands of herbarium specimens in the leading herbaria of Australia, especially New South Wales. The basic idea in coding was to cover the normal botanical range of a species, but not allow for freak or doubtful specimens. When a species shows only a tendency to a given condition the feature is marked with a bar, e.g. "$\overline{24}$". The bar is also applied to geographical distribution when the occurrence is limited or very rare, and to features which are found as an occasional alternative to the normal condition. In the case of valves the coding is sunk, more or less rim level, exserted. A species in which the valves are usually sunk but at times tend to be more or less rim level would be coded 59, $\overline{60}$.

Full acknowledgements are made to Mr. Anderson for his help in providing a sample card of his herbarium key and in allowing access to the extensive herbarium material under his control. Thanks are due to Mr. D.A.N. Cromer, Officer in Charge, Resources Division of the Forestry and Timber Bureau, for help in suggestions and in the loan of equipment in making the set of illustrations; and to the Government Botanists of Queensland, Victoria and Western Australia, and the botanists of Adelaide University and the University of Tasmania.

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Timber Prospects in the U.S.S.R.

Material assembled for the recently published study on European Timber Trends and Prospects

by ECE/FAO Staff

Any discussion of the possibility of obtaining substantial supplies of sawn softwood from the U.S.S.R. in the near future must be based on the fact that, in sharp contrast to those of the United States and Canada, its economy is centrally controlled. In managing the softwood resources of the country, the Soviet authorities may be presumed to have two ends in view, consistent with the conservation of the forests themselves: to obtain as much wood as possible to meet their own domestic requirements and to export up to the point where the goods which they can buy with the foreign exchange secured no longer justify the costs involved in supplying the timber. In any assessment of export prospects, it is accordingly necessary to examine the size of the total resources available, and to judge how far the claims of the domestic and the export markets conflict with one another.

The total forest area of the U.S.S.R. is very large. According to the latest statistics available, it is approximately 700 million hectares, compared with 250 million hectares in the United States and 145 million hectares in Europe. Moreover, 80 percent of these forests consist of conifers capable of yielding softwoods of the greatest importance for the world's timber market; and the potential softwood resources of the U.S.S.R. are roughly double those of the rest of the world put together. The distribution of these forests, however, is unfavorable. Most of them are situated in the sparsely settled northern areas, where land communications are inadequate, whereas the densely populated and industrialized areas of the south and west are relatively bare.

One result of this unfavorable distribution is that the average rate of growth is very low, the annual gross increment being estimated only at about 1.1 cubic meters per hectare. According to the Deputy Minister of Forestry of the U.S.S.R.[1], 55 percent of the trees in full-grown forests of the U.S.S.R. are over 120 years old and are ripe for cutting or over-ripe, while only 14 percent are less than 40 years old[2]. Thus, since much of the Soviet forest area is not being logged at present, a considerable proportion of the timber wealth of the country is deteriorating in quality or being lost as the older trees die, decay, are damaged by insects, or burn in forest fires. The average growth per hectare is also low because, over huge tracts of the less accessible forest areas, the trees are thinly spread.

The naturally unfavorable geographical distribution of the forest area has been made still worse by the heavy depletion which has gone on for over a century in the easily accessible forest areas of central and southern Russia.[3] The Soviet State has introduced laws designed to enforce a forest management consistent with the principle of sustained yield, which have had the effect of reducing annual fellings in these areas. Because of forest depletion and because of climatic conditions in the less accessible forest areas, the Soviet timber industry is faced with the fact that the timber which it requires in steadily increasing quantities has to be brought over ever-greater distances under the most difficult transport conditions.

In the inter-war period, nevertheless, total fellings rose steadily from 350 million m.^{3} in the 'twenties to about 500 millions just before World War II. After the war, in spite of the acquisition of territory which included considerable economically important forest areas, the U.S.S.R. found it difficult to raise production to the level required to meet rising domestic needs. The end of the war saw the Soviet timber industry in a serious plight. A shortage of labor added to the problems caused by excessive wear and tear during the war and the considerable loss of manufacturing capacity which had been sustained. It was reported that Hitler's armies demolished lumbering establishments with an annual production of 64 million m.^{3}, as well as a large number of woodworking factories, plywood factories, match factories and pulp and paper mills. The industry also lost half its tractors, trucks and narrow-gauge locomotives.

[1] "Individual Results of the Post-war Five-year Plan and Forestry Tasks for 1951", by V. Y. Koldanov, Deputy Minister of Forestry of the U.S.S.R., *Timber Economy*, Moscow, 1951.

[2] This is in marked contrast to the rest of Europe, where, though age-classification data are scanty, it is generally believed that the percentage of over-ripe trees is negligible, while trees under 40 years old account for between 40 and 50 percent of the total growing stock.

[3] Khrouschov, the Wood Demon, in Tchehov's play of that name (better known in its later version as *Uncle Vanya*) is made to say:

"Cut forests when it is a matter of urgency, you may, but it is time to stop destroying them. Every Russian forest is cracking under the axe; millions of trees are perishing; the abodes of birds and beasts are being ravaged; rivers are becoming shallow and drying up; wonderful landscapes are disappearing without leaving a trace." (Act I, Scene VII). And later, "To fell a thousand trees, to destroy them for the sake of two or three roubles, for women's rags, whims, luxury... to destroy them, so that posterity should curse our savagery." (Act III, Scene XII). *The Wood Demon* was written in 1889.

Progress since the war

Since the end of the war, however, the industry has made great strides. Tremendous efforts were made to restore its productive capacity; and, in order to alleviate the labor shortage, great emphasis was laid on increased mechanization at every stage from extraction to processing. By 1948 the annual roundwood cut had been restored to the prewar level; and, in 1950, it is reported to have reached 600 million m.^{3}, of which 280 millions were industrial wood. As elsewhere in Europe, the proportion of the total cut turned to industrial account has steadily risen. The proportion of fuelwood — 65 percent in the 'twenties — had fallen to 53 percent in 1950. Nevertheless, in spite of these successes, the Soviet timber industry has failed to match the tremendous demands made upon it by Russia's needs for reconstruction and industrialization. Almost alone among the major sectors of the Soviet economy, it has narrowly failed, year after year, to fulfil its plan.

The industry's difficulties in meeting the demands made upon it may well continue. The Soviet Union's domestic needs for sawn softwood are certain to grow [4] Since the war, the restoration and development of both heavy and light industry have met with considerable successes; and more emphasis may be laid in future on raising the housing standards of the people because, though the worst ravages of the war have been repaired, these are still low in comparison with western European standards. Such a program is likely to make even greater demands on the Soviet timber industry than those it has had to face in the recent past, in spite of the fact that, in the U.S.S.R. as elsewhere in Europe, there is a strong movement away from wood for constructional uses.

Against this background of domestic scarcity, what chance has Europe of obtaining from the Soviet Union the million standards or so of sawn softwood (about 8 million m.^{3} roundwood equivalent) which it may need for instance in 1960 if it is to satisfy both its own requirements and maintain its exports to its own traditional markets overseas? They can hardly come from those areas around Archangel or with ready access to the Baltic Sea, from which supplies have been received in the past. These have been heavily overcut; and, since their communications with the chief deficit areas of the Soviet Union are reasonably good, their output is increasingly directed towards meeting domestic requirements. Nor is sawn softwood likely to be exported from Black Sea ports. If, therefore, supplies are to be received on any considerable scale, they must come either from Siberia or from the remoter areas of European Russia which open on the Barents Sea. Much of the virgin forest there will be worth exploiting only if export markets can be found, because the cost of moving the timber overland to inland centers of consumption would be prohibitive. Soviet plans for opening up these forests are therefore of particular interest to Europe.

Development prospects

As early as 1931, the Soviet Planning Bureau had before it memoranda and plans for the opening up of Siberian forests to the world market through the Arctic sea-route. Wobly [5], for example, commented in his plan that the great northern sea-route might be the basis for solving the coming world timber crisis and the world timber problem. At that time, Wobly's proposals were sharply criticized; he was accused of being less concerned with the interests of the U.S.S.R. than with supplying the timber requirements of the capitalist world. Nevertheless, in recent years, great efforts have been made both to develop timber production in this area and to make the Arctic sea-route a reality. The route is now serviced by 130 polar radio stations, a score of scientific stations and a fleet of icebreakers. While these are partly concerned with maintaining direct sea communications between Archangel in the west and Vladivostok in the east, they also contribute towards a solution of the problem of clearing timber from the basins of the Ob and the Yenisei if and when that problem needs to be faced. Exports from these districts, and indeed from the whole forest area east of Archangel, raise, however, serious problems. Considerable development of such ports as Mezen, Naryan-Mar and Igarka, the "Archangel of Siberia", will be required. Since both floating operations and navigation are limited to a very short season of about three months, correspondingly greater port facilities and shipping resources are needed to clear the timber.

Many western observers are sceptical of suggestions that the Soviet Union may again be able to export large quantities of sawn softwood in the near future, for they see no possibility that these can be spared from domestic needs. The discussion above suggests that they have overlooked the fact that domestic and export supplies could come from quite different areas. While it is probably correct that exports from the traditional exporting areas of the Soviet Union are unlikely in future, supplies from Siberia and the northeast of European Russia might be possible on a considerable scale if the technical problems of extraction and shipment can be solved. In the early postwar years there was no possibility of making the necessary labor or equipment available; they were needed for areas better situated for supplying the domestic market. Even now,

[4] The fifth Five-Year Plan, published in August 1952, aims at a 56 percent increase in the haulage of marketable timber by 1955 as compared with 1950. The following extract from the Plan is of particular interest:

"12. To eliminate the lag in the timber industry compared with the growing demands of the national economy. To increase production of sawn timber and develop production of details for industry and building. To realize, on a broad scale, rebasing of timber production in densely wooded districts, especially in the districts of the North, the Urals, West Siberia and in the Karelo-Finnish Soviet Socialist Republic, restricting lumbering in thinly wooded regions of the country. To reduce seasonal work in lumbering and for this purpose to build mechanized enterprises, ensuring for them a permanent working personnel. To ensure continued complex mechanization of lumbering. To improve organization of production and utilization of equipment ensuring higher labor productivity in lumbering. To increase, during the five years, the commissioning of powerful sawmills in new lumber districts approximately eightfold compared with the number commissioned in the previous five years.

"To ensure all-round development of paper, cellulose, furniture, plywood, wood-chemical and hydrolysis industries. To increase output of furniture not less than three times."

[5] Wobly: *Problemy severa* (Gosplan), p. 33, Moscow, 1931.

their employment in these outlying regions will involve considerable expense; and, as a result, the cost of the timber must be expected to be high. But the European price of sawn timber is more likely to rise than to fall over the next decade.

High prices by themselves, however, will not induce the Soviet authorities to undertake the large investment involved in opening up these forest areas unless they can feel confident of spending the proceeds on goods which they want to buy. Recently, increasing tension between East and West, accompanied by restrictions on the type of goods which western European countries were prepared to export to the U.S.S.R., has robbed the trade of much of its attraction.

Nevertheless, there were some encouraging signs in 1952. Early in the year, the chairman of the Soviet timber export agency *Exportles* indicated that the U.S.S.R. was already in a position to export timber to Europe and elsewhere. And, in fact, Soviet sawnwood was on offer on the European market in the spring; but as prices were by then already racing downwards these offers failed to elicit any enthusiastic response. At the same time, statements by the Soviet delegation to the Economic Commission for Europe, and at the Economic Conference held in Moscow, indicated that the U.S.S.R. was prepared to import, in addition to engineering products, large quantities of consumer goods from western Europe. Such a policy would fit in well with the desire of several western European countries to find additional markets for their exports, notably of textiles. At the same time, their continuing shortage of dollars increasingly directs their attention to non-dollar sources for their raw material supplies.

Future export possibilities

There can be no doubting the fact that every European importing country is intensely interested in the possibility of resumed large-scale shipments from the U.S.S.R. The reason is not far to seek. From the beginning of this century until the outbreak of World War II, Europe's timber balance has been closely related to the amounts entering Europe from the U.S.S.R. including, in the inter-war period, exports from the Baltic States. In 1913, Europe's net imports of sawn softwood amounted to over 1.5 million standards; Russia's exports to Europe in this year were 1.3 million standards. With the cessation of Russian exports after the war, Europe's net imports fell almost to zero. From the mid-twenties, when large-scale shipments were resumed, Europe's softwood balance moved in parallel. After World War II, Europe was again cut off from Soviet supplies; net imports sank and, by 1950, though short of softwood for its own essential needs, it had become a net exporter.

Fundamentally, then, the answer to the question whether the Soviet Union will export large quantities of sawn softwood to Europe must depend on two factors, one technical and one politico-commercial. The technical problem, which may be seriously tackled only if the political problem is solved, is to raise export availabilities and port facilities in the Soviet far north to a level at which exports on the required scale become practicable. Its solution lies wholly in the hands of the Soviet Union. The technical achievements reported in recent years from the U.S.S.R. in construction, industry and communications suggest that it is capable of solving this problem, too, if it considers it worth its while. The politico-commercial problem is to convince the U.S.S.R. that it is. Purely commercially, the prospect is that the price of sawn timber will, in itself, seem to be attractive in the next decade. Politically, the present tension between East and West must be relaxed until it is possible for the Soviet Union to choose freely how it will spend the proceeds of its timber sales on the goods which it considers most necessary for its peaceful economic development. Wise counsels will be needed in both camps if such relaxation of tension is to be achieved. If it can be, however, there seems to be no reason why the U.S.S.R. should not in the future play as decisive a role in the European softwood market as it has been accustomed to do in the past.

Appendix

Forested area in USSR	*Milions of ha.*
Forested land	628.3
Open areas	114.3
Total forest land	742.6

VOLUME OF STANDING TIMBER

Category	Miliards of m³	%	Ha. covered %
Mature and ovr-ripe forests	52.5	90	55
Maturing forests	2.9	5	16
Young forests			15
Saplings	3.3*	5	14
TOTAL	58.7	100	100

* Includes quantities of unexploited forested

Source: V. Ya. Kaldanov, "Some Results of the Post-war Five-Year Plan in the Field of Forestry,,, *Lesnoye Khozyaistvo*, No. 1 (28), January 1951.

Commodity Report

Plywood

The remarkable increase in world plywood production after the Second World War continued throughout 1951. Output, excluding that of the U.S.S.R., estimated at 3,140,000 m.³ in 1948 and about 3,580,000 m.³ in 1949, had reached some 4,770,000 m.³ in 1950 and as much as 5,560,000 m.³ in 1951, the year of a general boom in all forest industries (Table 1). In 1952, however, a slight fall in the output of the major plywood-producing regions was noticeable, their total production being tentatively estimated to be some 5,300,000 m.³ If all these figures are compared with the 2 million m³ produced before the war the increase is striking, about two-and-a-half times the output.

This growth in plywood production has been due more to recovery or expansion in traditionally producing regions, notably in North America, in response to increasing demand, than to new developments of capacity in areas which had no important plywood industry before the war. Although efforts have been made to expand capacity or to establish new plywood industries in Africa, Latin America and Asia, the level of output there has remained rather low and has, in fact, had practically no statistical effect on the total world figures.

TABLE 1 — PLYWOOD PRODUCTION
(coniferous and non-coniferous)

Reporting countries	1950	1951	1952
		1 000 m.³ (rounded)	
EUROPE	1 090	1 360	(1 200)
Austria	17	20	19
Belgium	12	12	12
Denmark	10	11	10
Finland	223	314	233
France	107	144	145
Germany, Western	372	480	419
Italy	110	140	140
Netherlands	27	30	(26)
Norway	12	12	(12)
Poland	(47)	...	...
Portugal	22	25	...
Sweden	45	45	(40)
Switzerland	19	20	(10)
United Kingdom	40	39	29
Yugoslavia	22	22	(22)
U.S.S.R.	[1]810	...	...
NORTH AND CENTRAL AMERICA	3 320	3 760	(3 650)
Canada	286	369	(370)
United States	[2]3 030	[2]3 390	(3 300)
SOUTH AMERICA	100	120	(130)
Argentina	25	29	...
Brazil	59	67	...
Chile	10	12	...
Surinam	6	9	...
AFRICA	10	12	...
Belgian Congo	[3]8	[3]8	...
Gold Coast	[3,4]1	[3,5]3	...
Southern Rhodesia	1	1	...
ASIA	170	265	(270)
Ceylon	4	2	...
India	3	4	...
Japan	149	233	...
Philippines	[4]13	[5]23	...
PACIFIC AREA	82	82	(80)
Australia	69	68	...
New Zealand	13	14	...
TOTAL (excluding U.S.S.R.)	4 770	5 560	(5 300)

[1] Planned figure. [2] Includes an estimate for hardwood plywood of 742,000 m.³ in 1951 and 660,000 m.³ in 1950. [3] Includes veneers. [4] Year 1950/51. [5] Year 1951/52. ( ) Estimated. ... Not available.

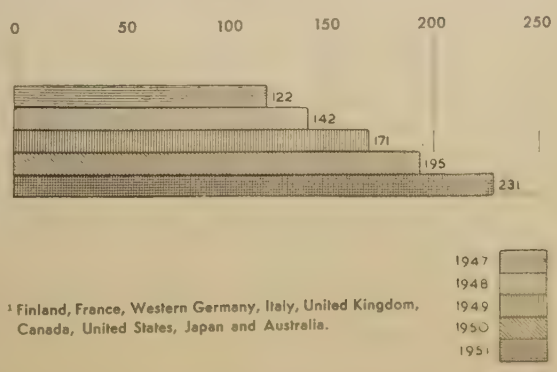
PRODUCTION BY REGIONS

Table 1 shows that the United States alone accounted for some 64 and 61 percent of world production in 1950 and 1951 respectively, as computed from reports received by FAO for the Yearbook of Forest Products Statistics. The combined share of the United States and Canada in the same two years represented about 70 and 67 percent respectively of the reported world total. About 23 and 25 percent of the total was produced in Europe in 1950 and 1951, and the rest of the world produced the odd 7 percent.

Europe

It will also be seen from Table 1 that the output of plywood in Europe rose from 1950 to 1951 by some 25 percent, which, as already mentioned, was largely due to the general boom in 1951 for all forest products. But

TRENDS IN WORLD PRODUCTION OF PLYWOOD
Selected countries[1]
Index 1946=100



[1] Finland, France, Western Germany, Italy, United Kingdom, Canada, United States, Japan and Australia.

the output of producing countries of minor importance seems to have remained more or less unchanged, and the steep rise was in the four major producing countries: Finland, France, Western Germany and Italy. Towards

the end of 1951, production in Europe as a whole began to fall as a result of a general decline in demand caused by high prices and fairly large stocks with consumers and thus increased stocks at most of the mills. Figures of output during 1952 already available for three of the above four countries show a drop of some 13 percent below that of 1951. The total plywood output in 1952 of European countries reporting to FAO may tentatively be estimated at some 1,200,000 m.^{3}, as against 1,360,000 m.^{3} in 1951. But the decline in demand chiefly affected production in the principal exporting countries. In Finland, output in 1952 was 233,000 m.^{3} as against 314,000 m.^{3} a year earlier; in western Germany, the output fell from 480,000 m.^{3} in 1951 to 419,000 m.^{3} in 1952. Output of the French plywood industries remained practically unchanged, being 144,600 m.^{3} in 1952 as against 144,000 m.^{3} the year before, and in Italy the plywood industries were reported to have maintained their production at 140,000 m.^{3} both in 1951 and 1952.

North America

In North America, the output of plywood reached an unprecedented volume in 1952. In the United States in 1952 it was m.^{3}, as against 3,390,000 m.^{3} the previous year, or a rise of some 15 percent. In Canada, however, output seems to have remained fairly stable, being 370,300 m.^{3} in 1952 compared with 369,900 m.^{3} the previous year. The increase in plywood output in North America is believed to be due to the fact that building activity and modern design of housing construction maintained demand at a high level.

Latin America

Output of plywood in Latin America did not increase to any marked degree from 1949 to 1950 and rose only by some 11 percent in the boom year of 1951. A notable percentage increase took place in Surinam, where output in 1951 was some 50 percent higher than in 1950. In Brazil, the increase appears to have been close to 14 percent and in Chile 20 percent. Although no figures are available for production in 1952, it is believed that falling demand abroad may have affected the Brazilian plywood industries, but elsewhere in Latin America domestic demand is not likely to have been affected by the decline on international markets; on the contrary, it has shown signs of increasing.

Other regions

A most noteworthy increase in plywood output has been that of Japan, where it rose from 83,000 m.^{3} in 1948 to 147,000 m.^{3} in 1949 and 149,000 m.^{3} in 1950, reaching 223,000 m.^{3} in 1951. Although much of this increase went to exports, the main part was still utilized to meet domestic demand. In view of the great demand for building materials in the East, it seems reasonable to assume that the Japanese plywood industry will not have declined as steeply in 1952 as has been the case in Europe. In contrast to the rather modest increase in output of most other countries, that of the Philippines is worth mentioning, as it rose from 13,000 m.^{3} in 1950 to 23,000 m.^{3} in 1951. The expansion of plywood production on the Gold Coast of Africa, although not great in volume, nevertheless trebled between 1950 and 1951.

Trade

Exports

The trade boom in 1951 caused world exports of plywood to rise substantially. The volume reported to FAO, which in 1949 had been some 350,000 m.^{3} and in 1950 330,000 m.^{3}, rose in 1951 to 510,000 m.^{3}. As may be seen from Table 2, this rise was chiefly due to increased exports by European countries; exports by Finland alone rose from 195,000 m.^{3} in 1950 to 278,000 m.^{3} in 1951. Of other European countries, France, Western Germany and Italy increased their exports substantially in percentage, although the increase by volume was much lower than that of Finland. Exports by other regions, with the exception of the Pacific area, also registered increases which, while in some cases being substantial in percentage, were less important by volume. Increases worthy of note took place in African exports,

Table 2 — World Trade
(Coniferous and non-coniferous plywood), 1000 m.^{3}, rounded

Reporting countries	1950		1951		1952	
	Imports	Exports	Imports	Exports	Imports	Exports
Europe	(300)	(250)	(440)	(380)	( )	( )
Austria	...	...	1	1	1	*
Belgium-Luxemburg	30	2	32	5	24	2
Denmark	...	...	16	1	11	1
Finland	*	195	*	278	*	221
France	*	12	*	24	1	11
Germany, Western	16	14	20	23	22	6
Greece	...	—	6	—	6	—
Ireland	...	—	11	—	3	—
Italy	1	2	*	12	1	5
Netherlands	30	3	40	4	18	4
Norway	...	...	7	1	5	1
Sweden	7	24	9	22	...	...
Switzerland	...	...	3	*	3	*
United Kingdom	183	1	304	1	255	1
Yugoslavia	—	...	—	3	—	1
North and Central America	(40)	(40)	(50)	(50)	...	...
Canada	1	32	3	42	8	43
United States	37	3	44	4	...	...
South America	...	(20)	...	(25)	...	...
Brazil	*	11	*	11	...	...
Chile	—	3	—	5	...	...
Surinam	—	6	—	9	...	...
Africa	(40)	(2)	(40)	(10)	...	...
Algeria	5	*	6	*	...	...
Belgian Congo	—	1	—	5	...	...
Egypt	19	—	22	—	...	...
Asia	(20)	(20)	(20)	(50)	...	...
Japan	—	16	—	49	...	...
Pacific Area	(10)	(*)	(20)	(*)	...	...
Australia	7	*	20	*	...	...
Total	(410)	(330)	(570)	(510)	...	...

( ) Estimated. ... Not available. * Less than half the unit. — Nil.

especially those from the Belgian Congo (1,000 m.^{3} in 1950 to 5,000 m^3. in 1951), and in exports from Japan, which rose from 16,000 m.^{3} in 1950 to 49,000 m.^{3} in 1951.

In 1952, the general level of world exports seems to have declined steeply, although figures are available only for Europe and North America. The total exports of plywood by European countries fell by some 23 percent from 1951, the decline in exports outside Europe being particularly marked and reaching only some 70 percent of the 1951 shipments. Export totals from Canada and the United States, although less important in volume, rose by about 9 percent, but this increase was entirely due to trade between the two countries, as in fact exports to other regions declined by more than 60 percent. Of all the European countries, Finland was affected most severely since, being the largest exporter of plywood in the world, it is most sensitive to changes on world markets.

Judging by figures available for 1952, the total volume of world plywood exports in that year may be around 20 percent below the 1951 figure.

Imports

The world rise in trade between 1950 and 1951 was chiefly due to increased imports by European countries, which took 300,000 m.^{3} in 1950 and 440,000 m.^{3} in 1951, of which 24,000 and 52,000 m.^{3} respectively were from other regions. The United Kingdom imports, rising from 183,000 m.,^{3} in 1950 to 304,000 m^3 in 1951, accounted for more than 75 percent of the total increase in world plywood imports. Imports from Eastern Europe by the Western European countries increased from some 60,000 m.^{3} in 1950 to about 100,000 m.^{3} in 1951. Imports by most countries in other regions remained more or less unchanged, but the aggregate of North America rose from 40,000 m.^{3} in 1950 to 50,000 m.^{3} in 1951 (8,000 and 18,000 m.^{3} respectively being imported from other regions) and those of the Pacific area from 10,000 m.^{3} in 1950 to 20,000 m.^{3} in 1951 (Table 2).

Inter-regional trade seems to have suffered most in 1952. Imports by Western European countries from Eastern Europe fell by some 20 percent. The drop in total imports reported by the European countries was chiefly due to a fall in the figures of the United Kingdom (255,200 m.^{3} in 1952, as against 303,900 m.^{3} in 1951). Actually, imports into the United Kingdom from Finland rose from 102,000 m.^{3} in 1951 to 127,000 m.^{3} in 1952, and from Canada from 14,200 m.^{3} to 14,400 m.^{3}. Imports from the U.S.S.R. declined slightly from 71,500 m.^{3} to 61,400 m.^{3}, and from other overseas countries fell from 28,600 m,^{3} to 24,200 m.^{3}. As to the categories of plywood imported by the United Kingdom, imports of birch plywood were 162,000 m.^{3} in 1951 and 187,000 m.^{3} in 1952, whereas imports of other plywoods fell from 142,000 m.^{3} to only 68,500 m.^{3}.

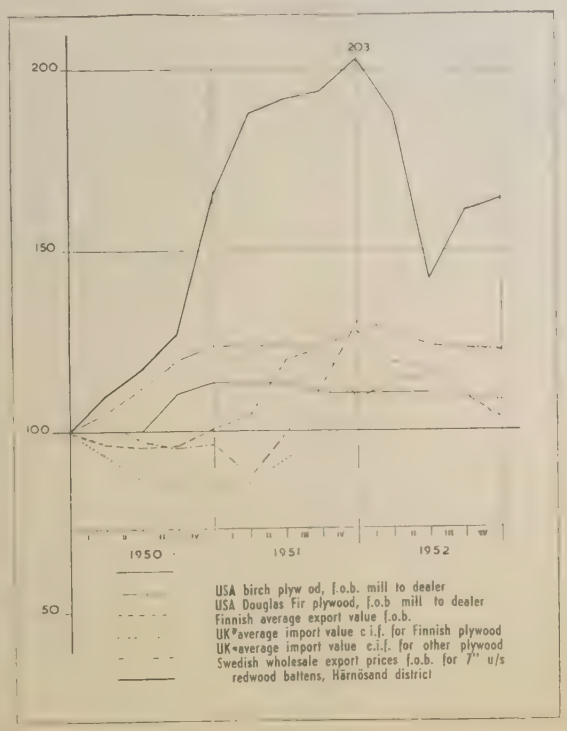
In North America, a slight rise in total imports of plywood was registered up to the end of September 1952, 37,300 m.^{3} as against 34,700 m.^{3} in the corresponding period of 1951.

Prices

The world development of plywood prices has been interesting, as prices in different regions and countries have from time to time moved in quite opposite directions. For instance, prices in the United States rose rather steeply during 1950, while in Europe they fell fairly heavily; on the other hand in 1951 prices more or less stabilized in the United States and rose strongly in Europe. By the end of the third quarter of 1952, however, prices in the United States and in Europe seem to have reached almost the same level, as is shown in the graph. The changes in plywood prices, although considerable between 1950 and 1952, by no means

MOVEMENT OF PLYWOOD PRICES

(January 1950 = 100)



followed the great fluctuations in the prices of other products. In fact, while the steepest rise registered for plywood prices was about 50 percent (Finnish average exports value f.o.b. for birch plywood) between the first quarter of 1951 and the end of the same year, after having been some 10 to 15 percent below the January 1950 level, prices of sawn softwood, particularly in Europe during the period 1950-1952, had increased as much as 100 percent and in some cases even more, and were never below the January 1951 level. Prices of wood pulp and pulp products had shown even greater changes, varying between 250 to 400 percent up and 40 to 60 percent down.

It seems rather curious, therefore, that the demand for plywood was as much subject to consumer resistance as that which had made itself felt in regard to other forest products as a result of excessive prices in 1951. The present prices of plywood are much closer to the level of prices at the beginning of 1950 (they are, in fact, some 10 to 20 percent above) than those of forest products in general, which are still some 50 percent

or more above the level of the beginning of 1950. In spite of the present relatively lower level of plywood prices, there has been no such noticeable strengthening in demand during the latter half of 1952 as has been apparent for other products, notably newsprint and sawn softwood. The explanation for this may lie partly in the increased competition from hard wallboards of all kinds, which seem during the course of 1951 to have become increasingly popular with consumers, and partly to the rapid growth of plywood industries, with which quality of output has not entirely kept pace.

Although the demand for plywood, particularly in Europe, seems at least temporarily to have declined more than that for other forest products, the market prospects are on the whole still satisfactory. A large part of the expansion of world plywood capacity now being carried out is centered in regions where the utilization of the natural supplies of raw materials has not yet so far been sufficiently developed, and where local demand is unsatisfied and constantly growing. Even with the expanding output in these regions, there should be no immediate cause for anxiety over export markets for the main exporting countries, especially in Europe which has so far had the largest overseas trade. On the other hand, the present marketing difficulties experienced by exporters do indicate a possible danger of over-expansion in the capacity of industries which rely on overseas demand.

INDIA: *Mr. S. Kamesam of the National Production Board demonstrating a new patented construction material* Sansteel, *made of bamboo and concrete. The* Sansteel, *here 4½ in. (11 cm.) thick and 20 ft. 6* in. *(6 m.) between supports, cots approximately U.S. $1.00 per m.².*

The Work of FAO

Near East Forestry Conference

Delegations from Iraq, Jordan, Lebanon, Syria, France, Italy, United Kingdom, and United States of America participated in a Near East Forestry Conference at Amman from 13 to 20 December 1952. The Director-General of FAO convened this meeting after the Government of the Hashemite Kingdom of the Jordan had generously offered to act as host.

Observers attended from the United Nations Relief and Works Agency and the International Poplar Commission. Messages regretting their inability to send representatives, but expressing support for the aims of the Conference, were received from Afghanistan, Egypt, Iran, and Pakistan. Several FAO Technical Assistance officers, working in the region, assisted in the deliberations.

Speaking on behalf of the Director-General at the opening of the Conference, Marcel Leloup, Director of the Forestry Division of FAO, said that it had proved possible to convene a conference at the present time because a "forest consciousness" was really being awakened in the countries of the Near East, mainly due to the personal initiative of a number of men of vision, several of whom he was glad to see attending the conference. The time was now ripe, he thought, to see what could be done through pooling the experience of various countries of the region, by international co-ordination of effort, and by making the best use of the facilities available through FAO for promoting sound forest policies. It was useless to disguise the fact that, of all the regions of the globe, the Near East was probably faced with the most serious forestry problems and those most difficult to solve. Forestry, he said, came up against inveterate customs and lack of understanding on the part of the very people who would stand most to gain from its success.

The Conference was formally opened by His Excellency Sayyid Musa Nasr, Minister of Finance, Jordan, who also attended some of the working sessions. (In Jordan the Ministry of Finance is responsible for the administration of all State domains, including the forests). In his introductory speech Mr. Musa Nasr was quite frank about the causes of forest degradation in Jordan, and throughout the Near East generally. In Jordan the tempo of destruction markedly increased during and immediately after World War I, when extensive forests of oak, juniper, pistachio, and even olive groves were ruthlessly exploited to provide fuel for the Hedjaz Railway and charcoal for the adjacent cities. A first step towards preventing unrestricted exploitation of the forests of the East Bank (formerly Trans-Jordan) was the enactment of a Forest Law in 1927, which placed all woods and forests deemed to be the property of the State under the administration of the Department of Agriculture and Forests. Since the State, however, held no clear titles, many difficulties arose. The next and most important step, continued the Minister, was the definition of title in each village throughout the country, with the result that all uncultivated land and the greater part of the existing forests were registered in the name of the Government. In order to avoid further disputes, the boundaries of State forests were clearly marked on the ground and surveyed on the cadastral maps.

In 1937 the control and administration of forests on the East Bank were transferred to the Department of Lands in the Ministry of Finance. Finally in 1952 a Department of Forests was created in charge of both Banks of the Jordan (the West Bank was formerly under the jurisdiction of the Palestinian Forest Service). The personnel of the new Department now totalled 162 officers and forest guards. On the East Bank an area of over 200,000 hectares had been registered as Government forests, and on the West Bank already about 900 hectares had been reserved for forestry. No doubt further large areas would be set aside during land settlement proceedings, which should be completed within the next twelve years.

In 1949, after the nucleus of a trained professional staff had come into being, the Government provided sufficient funds to permit a modest start to be made with the planting of denuded areas. In 1950 it was possible to commence large-scale operations by direct seeding, a method which previous experiments had shown to be the cheapest and the most likely to be successful. In addition, the United Nations Relief and Works Agency had undertaken as a relief measure the afforestation of some 2,600 hectares under the supervision of the forest staff.

After the Minister had spoken, Mr. Leloup went on to say that conditions in the region imposed particular obligations on foresters. They could not be satisfied with forest policy alone, but must also be concerned with grazing policy and even agricultural policy. It was essential to get even the small farmer interested in tree plantations of industrial species, as well as of other species such as fruit and fodder trees which would prove very useful to him. How could the farmer be induced to plant a tree wherever a tree might be useful to him? That was a problem which demanded earnest attention.

Mr. Leloup spoke before an audience of a great number of Government officers, technicians, and private citizens, whose sentiments were expressed by Mr. Ferhan Shibalat, Lord Mayor of Amman when he addressed a warm welcome to the members of the Conference and wished them every success in their endeavors.

Business of the Conference

Before starting consideration of the agenda, the Conference elected A. H. Hiloue, Director of Forests, Syria, as Chairman; Y. es Salti, Assistant Director of Forests, Jordan, and A. Berjaoui, Chief of the Forest Protection Service, Lebanon, as Vice-Chairmen; and appointed H. Kittani, Assistant Director-General of Forestry, Iraq, as Rapporteur. The main decisions of the Conference were as follows:

Forest policy and conservation

The Conference recommended that governments should take measures, including the use of air survey, to speed up the reservation, demarcation and inventory of national forests, making provision for the settlement of claims to ownership titles and the definition in law of forest rights and *ab antiquo* usages. Due weight must be given by governments to forestry in land use planning, so that the role of forestry was not subordinated to the needs of agriculture and animal husbandry but kept in proper perspective in relation to all other forms of land use. The prime function of each forest reserve should be defined The Conference affirmed the need for forest services to have adequate powers, backed by law, for the protection and development of each country's forest estate.

It suggested that all forms of grazing which were incompatible with proper silviculture be excluded in forests where protection or produc-

(*continued on page 80*)

Siria. *When winter comes the hill slopes have to give up every woody remnant for fuel. Yet there are some fine forests in Syria which can still be saved from destruction. An FAO officer is advising on forest reservation and management, especially of the forests, mainly of* Pinus halepensis, *in the Latakia district where abundant natural regeneration is obtained.*

Chile. *One of the larger FAO missions has been working in Chile and has received the full support of the President and the Government. It has co-operated with the International Bank in producing a comprehensive report on "The Agricultural Economy of Chile" which is likely to form the basis for the future development of the country. A new forestry school has been started with an international staff provided by FAO.*

* * *

Technical Assistance Activities

Right round the world in 27 countries from Iceland to Chile, from Libya to Iran, and from Pakistan to the Philippines, FAO technical assistance is helping towards the conservation and wise use of forests and rangelands and towards increased production from forest industries. In many instances technical assistance has entered into a second phase, the planning for and implementation of activities recommended by specialists in the course of the initial phase. These photographs illustrate the variety of the work in which FAO is engaged.

* * *

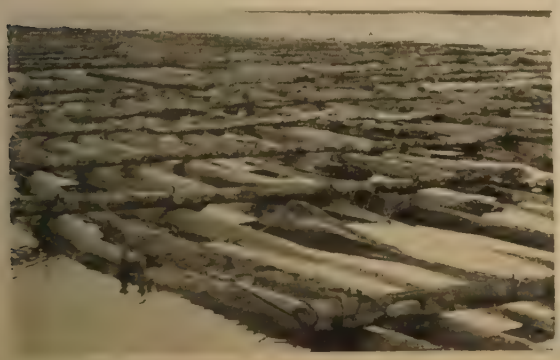
Ceylon. *These primitive catamarans may slowly be replaced by modern motor craft, though still constructed of wood. FAO fisheries experts think more efficient craft mean more and cheaper fish. For the first time in history, the best brains concerned with the design, construction, outfitting and operation of fishing vessels will meet at international congresses organized by FAO in Paris, France, and Miami, U.S.A., in October-November this year.*

India. *Proposals for improving the plywood industry have been put forward by a visiting specialist. A main difficulty found in nearly all factories producing plywood for tea-chests was the tack of mechanical driers. Veneers are mainly dried in the sun, on the roofs or on the ground round the factories, and they have no uniformity in moisture content.*

Iceland. *As described in the "News of the World" section, a forester from Alaska has been advising on an increased program of planting, largely with seed from Alaska which has proved most successful. Iceland has a forest policy, even though it has no forests. It has set aside areas for growing forests, passed laws to protect them, and created public consciousness of forest values.*

Iran. *A range management expert has been studying the conservation and improvement of the forest and natural rangelands.*

Paraguay. *An enlarged mission will be in Paraguay through 1953 to advise in more detail on activities recommended by the initial team. A new forest law has been drawn up and a structure proposed for a forest administration. Sixty percent of the country is forest, most of it practically virgin forest. Forest products make up over 50 percent of the country's exports, mainly roundwood like this raft of logs on the Alto Parana river.*



(continued from page 77)

tion was the main objective of management. In forests where livestock grazing was considered to be the most economic and satisfactory form of land use, care should be taken to control the intensity of grazing and to enrich forest grazing areas by scientific range management and the introduction of better fodder species. Adequate compensation or alternative subsistence must be offered for the grazing communities affected in cases where forest grazing must be restricted or eliminated. The introduction of improved breeds of animals, more intensive development of stall-feeding methods, and an increase in cultivated fodder resources were called for. Close collaboration should be established between all services concerned with this matter, in particular those responsible for agriculture, animal hunsbandry and forestry.

Finally, the Conference urged governments to give every consideration to the expansion and proper technical training of the staffs of their forest services.

Afforestation and reforestation

The Conference took note of a number of interesting afforestation schemes that had already been carried out in the various countries of the region. The results of the experience already gained or to be gained should be exchanged between countries.

In view of the sparsity of natural woodlands and the general scarcity of timber and wood of all kinds, governments should encourage by a variety of means the planting on communal and private lands of fast-growing species, for instance poplars and eucalypts. The International Poplar Commission was requested to arrange for one of its next meetings to be held in the Near East.

Other recommendations concerned the certification of seed quality and origin, the exchange of plant material for research, and advice from FAO on correct methods of collecting and storing seeds.

Forestry propaganda and public education

In order that effective publicity should be given to countries' efforts to promote an appreciation of forestry and forest values, governments were advised to inculcate a "tree consciousness" in children of all ages through their school teachers, and a favorable public opinion through influential political and administrative personages, and through community leaders whose advice is commonly requested and followed by villagers. Since forestry work cannot be successful without the backing of the people, funds spent on forestry publicity and public education were not wasted. The interest of the public should be stimulated by providing "shop windows" in the form of practical demonstrations of tree planting, thinnings, and other approved practices.

FAO was requested to sponsor, in liaison with the forest services of Arab countries, the translation and publication of a simple forest terminology in Arabic, including definitions of technical terms.

Forest products and wood industries

Strong efforts are in fact being made in the region to step up future forest production through the introduction of systematic forest management. The Conference urged governments to continue these efforts. It was felt that great improvements in forest utilization could be secured through better charcoal-making techniques, especially the use of metal or masonry kilns.

Many of the Near East countries are or will soon become big exporters of fruits which raised the question of packaging and crating. FAO was asked to provide documentation on new types of packing, and on the manufacture and use of fiberboards, chipboards, and reconstituted wood.

His Excellency Fawzi-Selou, President of the Republic of Syria, planting a tree at Damascus on the occasion of the first Tree Festival to be celebrated in Syria, 25 December 1952.

A recommendation was made to investigate local forest species which could supply tannin materials; the inclusion of tannin-rich species in planting programs was proposed.

The needs of the populations in the region for fuelwood could not be met without continuing damage to the remaining forests. Governments should promote a policy of replacement of fuelwood by other sources of energy such as electric power, liquid gas and petroleum products, in which the region as a whole was rich.

Technical assistance

It was agreed that technical assistance of use to the region could take two forms, one that benefited each country separately and the other intended to help all the countries in the region collectively. The latter was in fact complementary to the former, and of high importance in the development of the Near East. The setting up of a Forest Reseach Center for the Near East where scientific and technical aspects of the forestry problems peculiar to the region could be studied, was a case in point. The translation and publication in Arabic of all kinds of forestry literature was another. The Conference recommended that interested governments should, in consultation with FAO, come to an agreement to set up at least one common forestry school for the training of forest guards; the teaching should be in Arabic. In the meantime governments should consider arranging through FAO to obtain the services of Arabic speaking forest rangers from countries where forest services were already well developed, to teach and train local staffs.

Near East Forestry Commission

The Conference agreed that it would be to the interest of countries in the region to be able to exchange information on forest policies and technical forestry problems on a continuing basis. It therefore recommended to the FAO Conference that the establishment of a Near East Forestry Commission should be approved, the secretariat to be provided by FAO, and the Commission be composed of governmental delegates.

Study Tours

During and after the conference, various study tours were organized through the courtesy of the governments of the Hashemite Kingdom of the Jordan, Lebanon and Syria, to give an opportunity to the participants to discuss in the field some of the questions considered in the course of the meeting. A forestry exhibition organized by the forest service was visited at Beirut, where the delegates also attended the Festival of the Trees, traditionally celebrated during the month of December in the Lebanon. (In Jordan it is celebrated in January.) They also attended the first observance of a Festival of the Trees at Damascus. The President of the Republic of Syria and the Prime Minister, together with various ministers and members of the Diplomatic Corps, attended the ceremony (*See picture*).

Logging Techniques and Training of Forest Workers

The FAO European Forestry Commission has a Committee on Logging Techniques and Training of Forest Workers whose terms of reference are "to foster international collaboration in the field of felling, logging and timber transport, in order to support national efforts aimed at increasing productivity, including output of labor, reduction of waste, prevention of accidents and the improvement in the standard of living of forest workers."

The first meeting of this Committee took place at Geneva in March 1952, and a second held at Helsinki from 16-25 February 1953, on the invitation of the National FAO Committee of Finland, was attended by delegates from eight countries – Austria, Finland, France, Western Germany, Italy, Sweden, Switzerland and the United Kingdom.

The Committee emphasized the need for rationalized methods in forestry so as to enhance productivity in forestry and forest management, and on improved tools and machines. Rational methods of logging are considered easy of application and give immediate results in increased production while ensuring a healthy development of the forest. Moreover, it is felt that rationalization of this kind can increase timber supplies by rendering more economic the exploitation of distant or inaccessible forests.

The first meeting of the Committee under the chairmanship of Mr. Winkelman (Switzerland) defined the main points to be studied. It was decided to review the research work on logging techniques undertaken in different countries, to investigate the question of comparison of performance ratings, and to carry out an enquiry into the mechanization of forest work. The International Labour Office (ILO) offered to collaborate in a study about training schools for forest workers.

The delegates to the second meeting of the Committee decided to complete the survey of institutes carrying out research work on logging techniques and to publish this list, together with a bibliography. The survey would be revised every two or three years.

Logging pilot techniques in Finland

An international study on performance ratings for the felling of coniferous trees of specified sizes under similar conditions of weather, site, etc., is to be attempted, but many difficulties stand in the way of obtaining reliable results in this field. A comparison of performance tables and salary contracts and a questionnaire on "best methods" as taught in training schools or courses are planned. It is proposed to arrange an international training course for timekeepers, probably in Switzerland.

The Committee has approved an interim report on the *Use of Power Saws* which will be submitted, on completion, to the next session of the European Forestry Commission in the autumn of 1953. A study on *Mechanized Loading of Timber in Finland* was the subject of a short report, and it was decided to amplify this with material available from other countries. The study on *Special Criteria and Equipment for Tractors*, which had been undertaken in collaboration with the Industry and Materials Division of the Economic Commission for Europe, was considered of considerable importance not only for tractor users but also for tractor manufacturers. After some revision the study will probably be published and a further broad study of the principal uses of tractors — in road building, hauling, transport and soil cultivation — is planned.

Further investigations will enable the interim report prepared by the ILO Secretariat on the training of forest workers to be amplified. It will be presented to the next session of the European Forestry Commission.

Thus this Committee has stimulated a valuable interchange of information and experience between countries on rationalization in forestry working techniques. Together with the International Union of Forest Research Organizations, it has given an impetus to research in this field and has enabled useful studies to be carried out aimed at increasing productivity in forest work.

Far Eastern Mechanical Logging Training Center, Philippines

In September and October 1952, forty forest officers, officials of Government timber exploitation departments, instructors from forestry colleges, and technical and managerial staff members of timber companies nominated by the Governments of eleven countries of Southeast Asia arrived in Manila, Philippines, to attend a course of training in mechanical logging. This course had been organized by FAO in collaboration with the Government of the Republic of the Philippines. The countries represented and the number of trainees sent by each were as follows: Burma (5), China (1), India (3), Indonesia (3), Laos (2), Malaya (7), North Borneo (4), Pakistan (2), Philippines (5), Thailand (7) and Viet Nam (1). At the end of December 1952, one additional fellow from Burma joined the course for two months.

The project stemmed from requests to FAO by several governments in the Southeast Asia region for experts to advise on mechanical logging. Judging by these requests, there appeared to be a real interest in the introduction of mechanized equipment and rather more modern methods of timber extraction than generally existed in most countries of the area. It was decided, therefore, to establish a Regional Training Center for instruction in mechanical logging and Mr. H. G. Keith (Canada), lately Conservator of Forests, North Borneo, was appointed to organize and direct the project.

After careful consideration of various proposals, the Director-General of FAO came to the conclusion that, from the point of view of mechanical logging alone and aside from any consideration of adequately controlled conditions recognized generally as being essential to good forestry, the Philippines would be the most suitable country in which to establish the proposed training center. It is, in fact, the only country in the region where mechanical logging is

the rule rather than the exception. Subsequent negotiations with the Government of the Republic of the Philippines resulted in the completion of a 'host' agreement which was signed in Manila on 3 April 1952.

Aim of the Training Center

The aim of the Mechanical Logging Training Center was clearly expressed by Sir Herbert Broadley, Chief, FAO Expanded Technical Assistance Program, in these words:

> "The aim of the proposed course of instruction is to provide training to selected forest officers, and selected persons from commercial enterprises, from various countries in tropical Asia, in mechanical logging under forest conditions that closely approximate those pertaining in the countries from which they come. It is essential that trainees, at the conclusion of the course of instruction, should have gained a clear idea not only of the *possibilities*, but also the *limitations* of mechanical felling and extraction of timber, including transport to sites of processing plants. In a course of training lasting only six months it is not possible to turn out logging engineers and skilled operators, but trainees should be in a position, when they return to their respective countries, to determine whether or not mechanical extraction can be applied economically and what equipment or system can be used or adapted to their local conditions. If the course of training accomplishes these objectives, the center can be regarded as having fulfilled its purpose."

The original scheme envisaged thirty trainees but later, owing to the interest displayed in the project, agreement was reluctantly given to increasing the numbers to thirty-five and finally to forty. This total was still insufficient to accommodate the number of nominations which governments proposed to make but, as it later proved, was larger than could be dealt with conveniently, particularly as regards food, accommodation and transport, and in the field, it also tended to interfere with observations.

Program followed

The Training Center officially opened on 4 October 1952.

A fairly detailed program had been drawn up, as follows:

> *1-31 October:*
>
> College of Forestry, University of the Philippines, Laguna, Philippines. Theoretical instruction and lectures by training center instructor and staff. Lectures by technical staffs on logging equipment, machinery, and related materials, and by manufacturers representatives and agents. Cinema films and slides showing machinery, equipment, etc.
>
> *1 November - 1 December:*
>
> Messrs. Nasipit Lumber Company, Tungao Logging Camp, Agusan, Mindanao, Philippines.
>
> *2 December - 1 January:*
>
> Messrs. Basilan Lumber Company, Mahayahay Logging Camp, Basilan Island.
>
> *2-29 January:*
>
> Messrs. Insular Lumber Company, Col. Griffin Logging Camp, Fabrica, Occidental Negros.
>
> *1-24 February:*
>
> Lumbering operations of Messrs. Benguet Consolidated Mining Company, Bobok Logging Camp, Mountain Province, Luzon.
>
> *25 February - 25 March:*
>
> College of Forestry, University of the Philippines. Review of operations and techniques studied in the field. Distribution of manufacturers catalogues and trade literature. Completion of reports. Lectures by technical staffs of representatives and agents of logging machinery and allied equipment manufacturers. Cinema films of machinery and equipment. Visits to various wood-using and forest products plants in Manila and vicinity. Mechanical Logging Training Center closes.

One Instructor (Professor G. Zamuco, Professor of Logging Engineering, College of Forestry, University of the Philippines); two Assistant Instructors (Foresters, Bureau of Forestry, Philippines); and an Administrative Secretary (Forester, Bureau of Forestry, Philippines) were seconded to the Training Center, and accompanied the trainees throughout the duration of the course. Mr. Florencio Tamesis, Director of Forestry, Philippines, was appointed honorary co-director of the Training Center and it was largely due to his untiring efforts that the aim of the course was achieved.

During their stay at the various lumber companies the trainees were given every opportunity to observe and study the various logging operations, and the methods and techniques peculiar to each company. Lectures were given by the technical staffs of the companies on all phases of the operations and questions by trainees were encouraged.

A few details relative to these companies are as follows:

The Nasipit Lumber Company. This company holds a concession of around 47,000 hectares on Mindanao Island; employs daily an average of 700 men in logging operations and 850 in the sawmills; production during 1952 was 26,328,243 bd. ft. (62,000 m³) of lumber and 245,151 m³ of logs. Methods employed by the company for extraction are high lead; tight line; heel boom loaders; steam donkey and diesel yarders; tractors; trucks and water transport. The principal species exploited are apitong (*Dipterocarpus* spp.), tangile (*Shorea polysperma*), red lauan (*Shorea negrosensis*), bagtikan (*Parashorea plicata*) and white lauan-almon (*Shorea almon*), *Pentacme contorta*, and mayapis (*Shorea squamata*); all but *apitong* are marketed under the name *Philippine mahogany*.

The Basilan Lumber Company. This company holds a concession of 24,000 hectares on Basilan Island; employs daily an average of 206 men in logging operations and 232 in the sawmills; their annual production during 1952 was 42,000,000 bd. ft. (99,000 m³) (log scale). Methods employed by the company for extraction are high lead; heel boom loaders; power loaders on crawler tracks; tractors, diesel yarders; logging arches; trucks and water transport. The principal species exploited are apitong (*Dipterocarpus* spp.), tangile (*Shorea polysperma*), red lauan (*Shorea* spp.), white lauan - *Shorea almon*, *Pentacme contorta*, kalunti (*Shorea kalunti*), and almon (*Shorea eximia*).

The Insular Lumber Company. This company holds a concession of about 66,800 hectares on Negros Island; employs daily an average of 700 men in logging operations and 1,300 in sawmills; 1952 production was 50,432,866 bd. ft. (119,000 m³) of lumber. Methods employed by the company for extraction are high lead; gin pole loading; steam donkeys and diesel yarders; tractors for railroad construction; rail and locomotives. The principal species exploited are red lauan (*Shorea negrosensis*), almon (*Shorea eximia*), apitong (*Dipterocarpus grandiflorus*), tangile (*Shorea polysperma*), white lauan – mayapis (*Shorea squamata*), bagtikan (*Parashorea plicata*).

The Benguet Consolidated Mining Company. This company holds a concession of 15,000 hectares in the Mountain Province on Luzon Island; in its lumbering and sawmilling operations it employs a daily average of 935 men; production, which is for the sole use of the company's mines, amounted in 1952 to 17,309,650 bd. ft. (41,000 m³) of lumber, 2,933,642 linear feet (894,000 m³) of slabs and lagging, and 1,500 m³ of round timbers. Methods employed by the company for extraction are modified North Bend sky line; aerial tramways; tractors for road construction; diesel yarders. The company exploits only Benguet pine (*Pinus insularis*).

Experience gained by trainees

During their stay in the Philippines, trainees had an opportunity to compare the relative merits of truck logging, under both dry and exceedingly wet conditions, with rail logging; tractor logging *versus* ground skidding, high lead, aerial tram, and sky line systems; and steam donkeys as against diesel yarders, all of which should be of the greatest value when considering introduction of mechanical extraction in their own countries. In addition, facilities were provided whereby they had opportunities to visit not only the sawmills of the host companies but also other plants using timber and other forest produce as raw materials.

While studying the operations of the main "host" companies, the trainees were able to make short visits to smaller operations and most of them took full advantage of these side trips. Some of the trainees unfortunately had had no previous experience or training in sustained jungle work, and there was a tendency in some instances for enthusiasm to wane as the course progressed, particularly when logging operations were attended by all the discomforts of rain, mud and heat.

It was partly for this reason that the original plan of integrating the trainees with the employees of lumber companies in the actual logging operations could not be put into effect, aside from the fact that the large numbers would have made supervision difficult under these circumstances.

Generally speaking it may be said that the aim of the training center was achieved. The majority of the trainees learned a good idea of the relative merits of the various logging systems that they had seen in the Philippines and the type of equipment that could be best adapted or adopted for use in their own countries, and most of the men will certainly think twice before installing any system, without modification, that may result in waste and forest destruction.

They themselves saw and were not slow to comment upon and criticize the damage that can result from mechanical logging operated without regard to, or careful consideration of, its effect upon the forest. It is most unlikely, therefore, that trainees returning to their own countries will recommend to their governments or their firms the haphazard adoption of any system of timber extraction that disregards the principle of sustained yield. As a result of their own observations, they have been forewarned of the dangers so aptly described in a recent critical review of technical assistance activities:

> " There is, of course, a danger that the techniques which will be applied with the greatest zeal will be those for more efficient destruction of forests... "

Trainees should, on the contrary, be in a position to introduce or advise upon the introduction of carefully planned methods of mechanical logging.

International value of the course

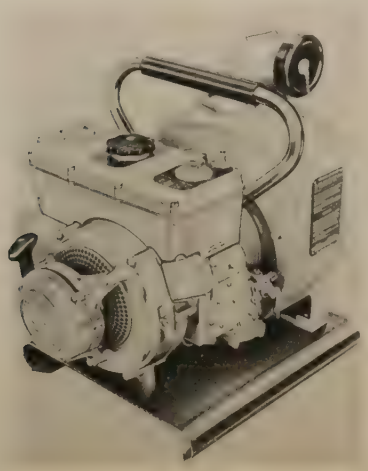
An account of the Mechanical Logging Training Center would be incomplete without some mention being made of the excellent relations that existed throughout the entire course amongst the trainees themselves, as well as with the various people in the Philippines with whom they came in contact. When it is considered that the forty trainees, consisting of almost twenty different racial strains from eleven countries, lived cheek by jowl for six months under conditions that cannot be described as luxurious, the fact that they maintained throughout the whole period a high standard of mutual respect and understanding would appear to be but yet another proof that a common interest is more important than racial, religious and linguistic differences.

Equipment News

Interest in the development of forest utilization and woodworking industries is reflected in the continual demand for information on new equipment. FAO's Forestry Division collects such information and passes it, on request, to Member Governments. Some of the information collected is published here. FAO accepts no responsibility for the claims put forward by manufacturers.

PORTABLE FIRE PUMP. — Self-priming centrifugal pump weighing 57 lb. (26 kg.) complete; capacity 15,000 gal. (57,000 liters) per hour. Delivers water at pressures up to 100 lb. (45 kg.) and is equally effective in delivering fog, spray, steam or foam. *Motor*: light-weight, two-cycle engine, with 7 h.p. capacity at 4,500 r. p. m. The pump has an automatic rewind, and cable type starter; lubrication from the fuel mixture with no greasing or separate oiling required. The non-clogging impeller is mounted on the engine shaft to eliminate bearings in the pump.

McCulloch Motors Corporation, 6121 *West Country Boulevard, Los Angeles* 45, *U.S.A.*



PORTABLE BRUSH GRINDER (*Model No. 3*). — Portable unit with self-contained power plant for grinding branches, tree trimmings and brush into small wood chips. Brush and branches are fed into the grinder where they are chewed into small usable wood chips and automatically blown into a truck or into a pile on the ground. The new model, No. 3, will take branches and brush (either green or dry) up to 6 in. (15 cm.) in diameter, and can grind from 2,000 to 3,000 lb. (900 to 1,350 kg.) of brush per hour. Easily transported, this model has standard ball type trailer hitch for fastening to jeep, car or truck. When unhitched, the retractable jack keeps the unit level and allows it to be moved easily.

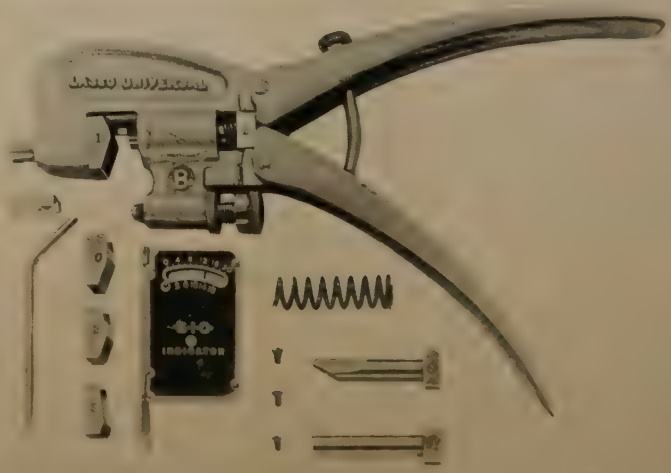
Mitts and Merrill Inc., Saginaw, Michigan, U.S.A.

ELECTRIC DECK CHAIN SAW. — Stationary version of the Danarm electric chain saw. It is powered by a 10 h.p. motor. The electric motor is normally adapted for operation on 380/440 volt, three-phase, 50 cycle A.C. supply. *Specifications*: saw is available with cutting widths of approximately 3 ft. 3 in. (1 m.), 3 ft. 1 in. (0.9 m.), 4 ft. 10 in. (1.5 m.), 6 ft. (1.8 m.) and 7 ft. (2.1 m.), and can be fitted if required with special long-wearing chromium plated saw chains to cope with the more difficult timbers.

J. Clubley Armstrong Danarm, Abford House, Wilton Road, London, S.W.1. England.

SAW SETTING PLIERS (*Lasso Universal, Model B*). — Saw setting device which will spring-set practically all saws with thickness ranging from 11 to 22 (Stubs wire gauges). Accessories consist of various tools comprising four dies (0, 1, 2 and 3), three different punches (A, B and C), two different tooth-beds, 1 spare spring, screws and a locking rod. The shanks of the pliers are devised to allow an easy interchange of tools to suit the gullet of the circular saws or millwebs, irrespective of thickness of saw if the correct punch is used; it will operate successfully on drag, log, felling, pit and one-man saws, as also on hand and back saws for cross cutting and ripping, whether the gullets are wide or dense.

Wilco Machine Works, 1301 *North Hollywood, Memphis* 8, *Tennessee, U.S.A.*

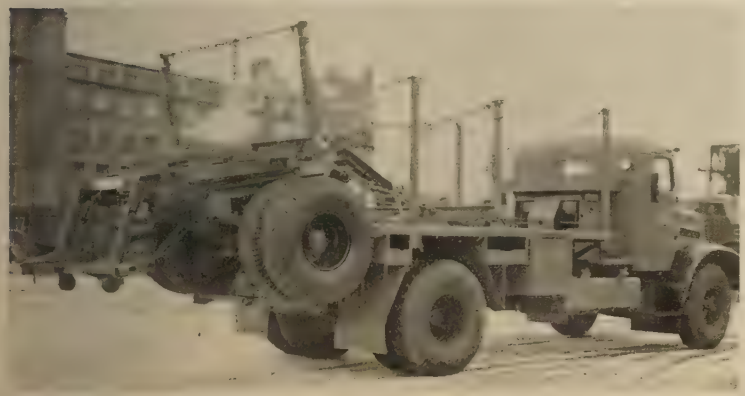


LOGGING TRUCK. — Truck constructed in four models to carry loads of 3, 4, 5 and 8 tons. Log is raised by means of a hand-operated winch; connecting shaft is adjusted to length of log by 4 screws; supporting hooks have safety fastener. Metal shield protects tires and brake drums; wheels fitted with conical steel hub in segments which prevent penetration by water and mud.

André Fleuret, Mondevert (Isle-et-Villaine), France.

MANDATOR MARK III. — *Specifications*: maximum gross weight without trailer, 31,360 lb. (14,224 kg.); weight with trailer or semi-trailer, 56,000 lb. (25,400 kg.) provided individual axle weights at the ground do not exceed 11,200 lb. (5,080 kg.) on the front and 20,160 lb. (9,144 kg.) on the rear. *Engine*: A.E.C. 9.6 liter, 6 cylinder, direct-injection oil engine, 4.72 in. (120 mm.) bore × 5.59 in. (142 mm.) stroke. Power developed, 120/125 b.h.p. at 1,800 r.p.m. Except when a single rear axle drive of 7.9:1 ratio is required, a more powerful engine is offered as alternative: A.E.C. 11.3 liter, 6 cylinder, direct injection oil engine, 5.12 in. (130 mm.) bore × 5.59 in. (142 mm.) stroke. Power developed, 150/153 b.h.p. at 1,800 r.p.m.

A.C.V. Sales Ltd., 49 Berkeley Square, London, W. 1., England.

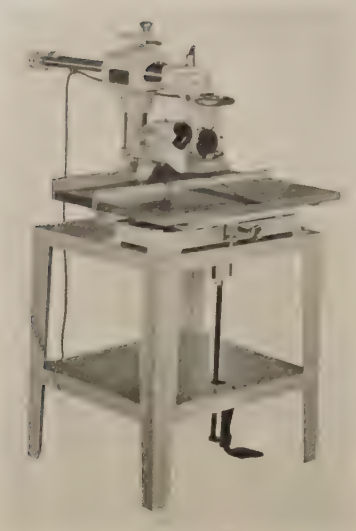


MODEL MK 26. — Trailer is raised onto the truck by means of a winch fixed behind the driving seat. Truck is available with 4-wheel drive if desired. *Specifications*: chassis carrying capacity, 16,750 lb. (7,600 kg.); gross vehicle weight with trailer, 78,900 lb. (35,800 kg.); road clearance-front, 1 ft. 7 in. (483 mm.), rear, 1 ft. 1 in. (330 mm.). *Motor*: 130 h.p. M.A.N. diesel engine: 6 speeds forward, 1 reverse ranging from 5 to 41 m.p.h. (8 to 66 km/hr.).

Maschinenfabrik Augsburg-Nürnberg A.G. (M.A.N.), Katzwanger Strasse 101, Nürnberg 24, Germany.

HEAVY DUTY LOGGING TRUCK. Model illustrated has gross vehicle weight of 70,000 lb. (31,750 kg.). Available in various engine, axle and transmission combinations ranging from gross vehicle weight 48,000-110,000 lb. (21,800-50,000 kg.). Logging trailers of 35 ton rating are usual complement to Model 30-70 trucks. Other trailers of 25 and 50 ton capacity are available in this series. *Motor*: Cummins 300 h.p. diesel engine, model NHRBS-600, with top speed of 33-35 m.p.h. (53-56 km/hr).

Hayes Manufacturing Co. Ltd., 225 West Second Avenue, Vancouver, Canada.



"COMET-CUB" RADIAL ARM SAW. – *Specifications*: overall height, 25 in. (64 cm.), on stand, 55 in. (140 cm.); width, 30 in. (76 cm.); length including arm, 36 in. (91 cm.); floor stand, 24 × 28 × 30 in. (61 × 71 × 76 cm.); table, 19½ × 30 in. (50 × 76 cm.); *motor*, ¾ h. p. 110 volt AC-DC. Capacities: depth of cut 2½ in. (6.4 cm.); width of cutoff, 12 in. (30.5 cm.); width of rip, 24 in. (61 cm.) net weight, 102 lb. (46 kg.). Optional equipment: heavy pressed steel floor stand with shelf, adjustable router table with foot operated raising device and micrometer depth adjustment, shaper fence, jointer, jig-saw, boring table, power take-off, sanding table, lathe, blades, cutters, chucks, bits, sanding discs, dados, planers, grinding, buffing and wire wheels, etc.

Consolidated Machinery and Supply Co. Ltd., 2029-33 *Santa Fe Avenue, Los Angeles* 21, *Calif., U.S.A.*

SAW BENCH "CIRCULEX", 14 IN. (36 *CM.* — *Specifications*: height, 31 in. (78 cm.); length, 24 in. (60 cm.); width, 15 in. (38 cm.).

Saw bench is made of heavy gauge steel plate. Powered by electric motor or petrol engine of 3 h.p., 2 h.p. or 1 h.p. for 14 in., 12 in. or 10 in. (36, 30 or 25 cm.) blade. The petrol engine is mounted on Dunlop rubber mountings, rendering saw bench free of vibration. Fully adjustable fence to suit blades of different sizes and tilting to 45°. Flush fitting push-button starters fitted on electric models. Guides on each side of the blade to take miter accurately calibrated to 180°. Guard for blade quickly adjustable and easily removed. Hardened and ground 1 in. (2.54 cm.) spindle running in self-lubricating bearings.

Alpha Machine Tools Ltd., Gallows Corner, Romford, Essex, England.

"RADYNE" (*Model H25/W*): Radio frequency glue-setting equipment with power output of 3 kw. Heat output control, full vision process timer and heat output meter are on the front panel. The gluing jig is connected to terminals positioned at the rear of the cabinet and not visible in this photograph. *Specifications*: input, 5 kw. 360/440 V. 3-phase and neutral 50 cycle. Width, 20½ in. (52 cm.); depth, 28 in. (71 cm.); height, 53 in. (135 cm.); weight, approximately 500 lb. (227 kg.).

Radio Heaters Ltd., Wokingham, Berkshire, England.

CROSS-CUT SAW 16 IN. (41 CM.) (*Type H.C.S.*). — Saw designed for sustained production work. No slide rails or rollers. Essential parts are totally enclosed and all controls are within reach. Operation is by foot pedal which is fitted along the front of the machine. A table of rigid design, 8 ft. (2.4 m.) long is fitted each side of the saw. Either side may be fitted with semi-auto stops and ruled stop bar or fixed fence. Rise and fall of the saw is effected by means of a handwheel. *Specifications*: cutting speed is controlled by a dial giving infinite variations up to 120 ft. (37 m.) per minute. The return speed is constant at 150 ft. (46 m.) per minute. Maximum cutting stroke is 20 in. (51 cm.) and maximum depth of cut is 5 in. (13 cm.); diameter of saw, 16 in. (41 cm.); speed of saw, 2,500 r.p.m.; saw motor (for 3-phase A.C. supply), 4 h.p.; pump motor (for 3-phase A.C. supply), 1 h.p.; length of standard tables, as fitted, 16 ft. (5 m.); width of standard tables, as fitted, 18 in. (46 cm.); floor area of machine (without tables), 4 ft. 3 in. × 3 ft. 3 in. (1.3 × 0.9 m.); overall height of machine, 6 ft. 3 in. (1.9 m.); weight complete, approximately 30 cwt. (1,524 kg.).

W. Kellam and Co., Bath Street Works, Belgrave, Leicester, England.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for reference purposes. FAO assumes no responsibility for statements in news items accepted in good faith from outside contributors.*

General

CEYLON

• The last annual report of the Chief of the Ceylon Forest Service announces the opening of a forestry field training school for rangers, who for various reasons are unable to attend the Forestry College at Coimbatore, and also for forest guards. During two three-month courses the training school, which has two centers, one in the dry and the other in the wet zone of Ceylon, has trained 17 rangers or assistant rangers and 35 guards.

CHILE

• An FAO officer writes of an air journey from Santiago to Balmaceda in Aysen province which provided him with an excellent opportunity for observation. He noticed that there were still extensive patches of natural forest, apparently *Nothofagus obliqua*, little damaged by fire on the foothills of the Andes as far north as the provinces of Linares and Nable between 36° and 37° S. The worst instance of destruction by fire seen north of Valdivia province was at 38° S., immediately to the west of Malleco National Forest in Malleco province. South of the region of Villarica Volcano, the pure forests of *Nothofagus pumilio* at high elevations immediately below the tree line stood out prominently, the foliage of this species being bright with autumn colors.

After Lago todos los Santos, the configuration became much more mountainous and rugged with narrow, deep, steep-sided fjords running from the sea far into the heart of the region, and further inland there was a confused mass of higher mountains, many of them with ice caps, intersected by deep valleys. In this region, the eastern portion of Llanquihue, there was a comparatively narrow coastal strip covered with dense evergreen forest which included even the rounded summits of the lower mountains.

Inland, where the mountains were much higher, their upper portions above the tree line were bare and rocky and frequently covered with small glaciers or snow. Evergreen forests were limited to the valleys and their place was taken at higher elevations by deciduous forests of *Nothofagus pumilio* and *N. antartica*. Sparse forests of these species occurred up to the tree line, and the growth on the northern or sunny aspects was notably more profuse than that on the southern aspects. Much forest in the valleys had been destroyed by fire, presumably for pasture.

Though the mountains of this region appeared forbidding in aspect, the climate in the valleys is fairly mild, but the difficulties of communication have up till now impeded agricultural development. In many cases, also, the valley floors need drainage. Apart from the valleys the rest of the region consists of lower slopes which could be kept permanently under forest, while forest growth on the upper slopes is physically impossible.

Further south, in Chiloe continental and in the northern portion of Aysen province, where the main chain of the Andes comes nearer the coast, and also inland from the high snow or ice-covered peaks on the eastern or Argentine side, the configuration was much less rugged. Here the FAO officer observed comparatively low, smoother hills, many wide valleys, lakes and extensive forests, again apparently mainly of *Nothofagus pumilio* and *N. antartica*.

This inland region, comprising the upper portions of river valleys which cut their way westwards through the main chain, was more densely populated than the region to north and west. Many scattered settlements were seen, both on the valley floors and on the low hills, as well as many sawmills eating their way into the forests and leaving desolation behind them. The wide valleys of this region have extensive areas of swampy land. Forests were mainly on the lower slopes while the hill tops had sparse vegetation and were free from snow during the summer months.

Balmaceda, at the end of the journey, is a small village on a bare windswept plain close to the Argentine frontier and lies on the eastern limit of tree vegetation imposed by climatic conditions. To southeast and east of Balmaceda there is no tree growth, but to the northwest there are forests of *Nothofagus antartica* and *N. pumilio* (mainly pure forests of the latter) which are stunted at first but attain fair height growth on the low hills between Balmaceda and Coyhaique.

KENYA

• A revised program of forest research dealing largely with silviculture, has recently been worked out as part of the program of the East African Agriculture and Forestry Research Organization. The main lines of work for some years are to be:

1. collection, analysis and distribution of the available information now widely scattered and unusable. This will involve preparation of a manual of East African trees, compilation of a list of introduced exotics, preparation of a bulletin on seed of indigenous and introduced species, compilation of a forest bibliography, and preparation of a glossary of technical terms;
2. standardization of research procedure;
3. study of softwood problems, including both seed and nursery problems, and covering planting-out problems and trial of further exotics;
4. stock taking or enumeration;
5. improving present unsatisfactory methods for regeneration of hardwoods;
6. determination of the effects of short-term cropping of wattle and gums on deterioration of the soil;
7. preparation of yield tables for important species, based on sample plots.

In addition, the organization is conducting work in forest pathology, particularly that of the native cypress.

UNITED STATES OF AMERICA

• The U.S. Department of Agriculture Library has issued several specialized bibliographies. One covers the economics of forestry, with 3,821 titles for the United States and Canada for the years 1940-1947, bringing up to date earlier bibliographies. The field is taken to cover value and price aspects of

1. forest and forest land use and tenure;
2. forest management for timber; water, forage, wildlife, recreation or other forest products;
3. industry based directly on forest products;
4. marketing of forest products;
5. consumption of forest products.

A second, already mentioned in *Unasylva*, covers the forests of continental Latin America, with 1,957 selected titles for the period 1920 to 1950. The bibliography includes general items and, separately for each country, forest descriptions, trees, timber and utilization of species.

A third bibliography, which covers the grading of logs and trees, includes both North American material, that selected from other continents and much that has so far remained unpublished.

• The State of Wisconsin has long placed great emphasis on conservation education of both youth and adult groups. Questionnaires were given recently to several thousand people in selected groups in an effort to estimate the success of the educational program to date and to determine areas in which strengthening was both needed and feasible.

A major result was to discover that neither high school graduates nor the general run of citizens had yet been reached by sufficient information on conservation nor of the principles behind it. Improvement can be obtained in several directions by:

1. strengthening and expanding teacher training in conservation by all feasible means;
2. emphasizing outdoor teaching of conservation;
3. expanding the already established system of school forests;
4. increasing attention to teacher training, especially through providing full-time conservation program advisors, assistants and consultants;
5. strengthening the financing of conservation education; and
6. working towards the establishment of a separate course in conservation at senior high school level.

Fundamental Science

Canada

• Of the various systems of site classification few have given practical consideration to the total site complex. A recent, field-tested method for classifying and evaluating the forest sites of Ontario undertakes to deal with the site as a whole. (Ontario Department of Lands and Forests, Division of Research, *Research Report No. 24*).

The main elements of the site may be grouped into:

(*a*) physiographic, the inorganic features of environment outside the works of man;

(*b*) biologic, the organic portions aside from man and domestic animals;

(*c*) cultural, man and his physical works, and domestic animals.

The most stable, though not necessarily most important, group is the physiographic, and it is therefore the primary point of reference, suitable whether the system of classification is to be local, regional or national in scope. The main groups of physiographic elements are:

(*a*) the ecoclimate, the climate to tree top level;
(*b*) the soil moisture regime;
(*c*) the nutrient regime.

Each can be conveniently subdivided into eleven classes, ranging from least to most.

Biologic features include the stage of succession and the genetic composition of the plant population; that is, whether available seed will give improved or deteriorated reproduction. Through a correlation of physiographic features, biologic features and the effects of cultural controls in regard to the biotic community and its changing total environment, it is possible to rate the capability of main physiographic sites for production of important species and types variously managed. Best adjustment of forest crop to total site also involves consideration of probable economic-social conditions expected to exist until the crop is harvested.

Mapping of sites on a regional scale as well as smaller units has proved practicable with this system. This approach and classification should provide the forester with a tool for the complex task of best utilizing the potential of each site. There is also much of value here for workers in other countries.

United States of America

• A comprehensive study has been made by the Southeastern Forest Experiment Station on hereditary variation as the basis for selecting superior forest trees. The problem is an urgent one for, although over 200 million young trees are planted annually, the seed used is collected where it is abundant and cheap rather than from superior trees and stands, and common silvicultural practice is to cut the better trees rather than reserve them to regenerate new stands. Thus the broad trend of practice is toward a degeneration of future forests.

To maintain the genetic quality of present stands and to improve those of the future, the following steps are needed:

1. establishment of new stands by planting or natural methods with seed from the best trees in the best stands;
2. tests, with seed or grafted material, of the best trees, stands, and races to isolate the best types, so that superior seed can be produced in the future;
3. a program of tree breeding to create new types.

The first two steps assume that heritable variations occur between trees and that they can be recognized. These assumptions are valid, based on world experience to date. In the traditional argument on heredity versus environment, foresters in the region tend too strongly to accept the dominance of environment, and recognize too little the opportunities for improvement due to genetic variation within species.

Heritable variation, as work in many countries has shown, may arise from various combinations of genes that control growth and form, through mutations — that is, sudden variations — and through variations between populations. The process of selection for tree improvement may be done either *en masse* or with individual plants, and both broad methods, with their subsidiary categories, can be applied in forestry. Selection may be made either for single traits, or preferably for a combination of desirable traits, and the objectives require somewhat different approaches, although single traits form the basis for combinations.

Vigor as measured by diameter, height and basal area has been found to vary greatly within even-aged stands of southern pines and can be identified readily. Selection for quality is more complex, involving such factors as straightness of stem, amount of butt flare, self-pruning qualities, rapidity of growth, straightness of grain, form of branching and other factors. In species grown for special purposes, such as for veneers, other factors come into the process of selection for quality, such as figure of grain, durability of wood, etc. Selection for resistance to disease and insect pests is of the greatest importance with some species.

In the application of selection to silviculture in general, volume growth is perhaps more important than quality, but inherent vigor is more difficult to manipulate through silvicultural practices than quality, and in selection of seed trees and reserve trees the forester should apply considerations of vigor, quality and resistance. As genetical viewpoints and techniques are more widely applied in the region, it is hoped to identify and mark superior trees and stands so that they may be available for detailed work by the regional Institute of Forest Genetics. As practitioners, the men who conduct silvicultural marking and seed collecting operations learn to look for, identify and put into practice the findings so far developed, improvement in the vast stands of the region should come about.

Union of Soviet Socialist Republics

• A study carried out by the Dokuchaev Institute for Research on the Soils of the Central "Chernozem" (black soil) Region on the effect of shelterbelts on micro-climate, compared the micro-climate of the steppe with that of land surrounded on all sides by belts planted with a mixture of elm, ash, birch and much oak. The average height of the trees varied between 16½ and 21½ m. and the width of the belts between 10 and 43 m. except in the east where width was standard at 106 meters. The fields enclosed by shelterbelts measured roughly 600 × 400 m.

In the region under study the same crop rotation was followed on all farms — forage, fallow and grain — and the fields under observation were either lying fallow or under winter wheat.

It was found that wind velocity 2 m. above the ground was, on an average, during the period of observation, from 1.7 to 2.4 percent higher on the open steppe. The influence of a 10-year old belt was found effective up to 300 m. while that of a 50-year old screen was still very marked at 400 m. and still apparent

at 1,000 m. A south wind with a velocity of 4.8 m. per second on the steppe dropped 10 percent near the southern belt of a field protected by shelterbelts, and did not exceed 70 percent of that velocity between two belts lying some 500 m. apart.

Shelterbelts reduce maximum air temperature by 1 to 2°, raise minimum night temperatures and increase relative humidity up to 10 percent. Ground temperature to a depth of 20 cm. was found to be higher in the spring between the shelterbelts than on the open steppe and during the summer the reverse was the case.

The influence of shelterbelts on snow melt and consequent run-off has also been investigated by a station of the Government Hydrology Institute. The layer of snow between the belts was, on an average, 1½ times that on the open steppe and the water reserves were proportionately higher. If the soil layer immediately under the snow is not frozen, a reasonably permeable soil can easily absorb the melt from relatively deep snow. On the other hand, if it is frozen, the first melting turns to ice on contact with the ground so that subsequent meltings give rise to intense run-off even from snow of no great depth.

The Institute calculated that forest cover prolonged the melting period by roughly 20 percent compared with that in open country. If a shelterbelt is established across a slope, snow melt from the land above is absorbed by the snow that still remains in the belt. When the latter in turn melts, the run-off is absorbed by the thawed ground of the uncovered fields below.

Silviculture

Chile

• An FAO Technical Assistance officer making a survey of the Malleco Forest Reserve reports on the forests situated in the valley of a large tributary of the Rio Escondido: "The upper end of the valley is well stocked with *Araucaria* occurring either in mixture with coigüe or pure. Most trees are from 4 to 6 feet (1.2 to 1.8 m.) in girth at breast height and 60 to 80 feet (18 to 24 m.) in height, but a few trees on favorable sites are much larger. One wind-thrown *Araucaria* had the following measurements:

total length: 120 feet (37 m.);
length of clear bole to first branch: 80 feet (24 m.);
girth at breast height: 18 feet (5.5 m.);
girth at 80 feet (24 m.): 12 feet 8 inches (3.9 m.);
girth at 110 feet (34 m.): 5 feet 10 inches (1.8 m.).

A fire had burnt a cavity inside this tree at its base, said to be used as a shelter in autumn by people who come to collect the seeds of *Araucaria*, an edible product highly valued. Incidentally, the abundance of young cones indicates that this is likely to be a good seed year for *Araucaria* in this region. Natural reproduction was plentiful in this stand, and the average annual height growth of seedlings was 10 inches (25 cm.)"

This officer also reports requests to the Forest Department for seed of *Fitzroya cupressoides* (alerce) from the Forestry Commission, United Kingdom; the Botanical Gardens, University of California; and from a plantation owner in South Africa. The United Kingdom has also asked for seed of *Nothofagus obliqua* and *N. procera*.

Somaliland

• The only vegetation type in Somaliland which may be described as forest occurs on the higher mountains at an altitude between 4,500 ft. (1,400 m.) and about 8,000 ft. (2,400 m.). The dominants are *Juniperus procera*, *Olea chrysophylla*, *Buxus hildebrandtii*, *Cadia purpurea*, and certain other species locally.

The formation probably survives from a period of greater rainfall. Accurate rainfall records do not date back very far, but the *Juniperus* forest appears to be within a belt which varies considerably, parts being as low as about 6 inches (150 mm.) some years and in other years over 30 inches (760 mm.). The mountains rise into a mist zone and, but for this, the forest probably would not exist. The forest is similar to that occurring in Kenya and other parts of East Africa as far north as Eritrea.

The formation varies from scrub on the more exposed parts to forest with a closed canopy at about 40 feet (12 m.), and with distinct shrub and ground layers. Most of the trees are over-mature, with large dead branches. Often one side of the tree is dead. Sometimes this state is brought about by people using fire to collect honey, but for the greater part these trees are dead or dying from old-age rather than any other cause.

Trees of younger classes are found, usually growing in even-aged groups, indicating that only in certain years are all conditions suitable for the establishment of a young crop. Such groups are too small and too widely spaced to replace the crop of over-mature trees, and there appear to be only two or perhaps three age-classes. Favorable circumstances for the establishment of new growth, therefore, only seem to have occurred at long intervals, possibly 40 to 50 years.

Lack of regeneration may be due to the fact that the forest, as well as being here out of its optimum climatic range, is suffering from continuous damage by man and his stock; the only remedy is enclosure (if this can be effected politically) and a gradual build-up to better soil and ground-layer conditions. It may be necessary to prepare the ground in some way such as making small bunds of brushwood and stone, or breaking the ground surface with a pick or crow-bar when seed are about to fall. Some sort of treatment of the seed may also be required. It has been said that *J. procera* regenerates more easily after a moderate fire than otherwise.

Union of Soviet Socialist Republics

• At the close of 1951 a general survey of the oaks planted in clumps or "nests" as an experiment in 1949 (reported in *Unasylva*, Vol. III, No. 6, p. 221) in the most varied regions of the grass and wooded steppes of European Russia was made under the supervision of the Department of Plantations for Agricultural Protection. The area covered was 3,184 ha., of which 938 ha. in collective farms ("kolkhozes"), 302 ha. in State farms ("sovkhozes"), and 1,944 ha. in forestry enterprises ("leskhozes").

The survey showed that the average number of young oaks obtained per clump was 10.3, and on 55 percent of the area, 15, and confirmed that oak was the species best adapted to steppe conditions. Stations which persisted in planting acacia, *Gleditsia* and maple, had very poor results. The oak, moreover, if properly sown and cared for, does not here come under the category of slow-growing species; for instance, it was found that in the third year the trees doubled or tripled the height of 2-year old trees. In some experiments, 3-year old oak attained a height of from 1.92 to 2.16 m., while some reached 2.42 m., the average gain in height in the third year being from 80 to 90 cm.

The meeting, at which the results of this survey were reported, was attended by the directors and foremen of crews of the "kolkhozes" who described the methods they had used and their achievements. From these reports it was learned that some "nests" had given much better results than row plantations because the trees were able to protect themselves better from the competition of the steppe grasses, their chief rival, and to withstand adverse climatic conditions better, creating within each "nest" from the outset a veritable forest micro-climate. In addition, "nest" plantations were more economical; the planting of a 1-ha. area within the protective belt in some cases required only six days' work, whereas under the same conditions row plantations required 42 days. Furthermore, between the rows of "nests" (generally numbering 600 per ha.) and in the spaces between the "nests", until such time as the crowns of the young trees met, it was possible to cultivate the soil, and produce fairly good agricultural crops.

Since intercrops protect the young oaks against too much isolation, and against parching by wind, and

prevent encroachment by weeds with strong roots between the rows, they are considered essential in some cases. Tall crops, the stalks of which are left standing over the winter after the harvest, are particularly useful for this purpose. These stalks protect the young oak against frost and ensure good snow cover and the retention of the snow melt.

The "nest" method has been widely used for several years for pine plantations on sandy soils. The method which has proved best is the planting of 50 × 50 cm. "nests" with a layer of from 5-9 kg. of fresh peat spread at a depth of from 25 to 35 cm. For 12 years peat has been used as a soil cover under row plantations of pine, but under these conditions it was necessary to use from 60-80 tons of peat per ha.; the new method calls for only 2 to 6 tons per ha. Moreover, where the first method was used, the roots did not penetrate very deeply, whereas "nests" with a peat layer penetrated to a depth of from 90 to 100 cm. and 85 percent or more of the trees struck root on bare sand. The main problem is to select the proper grass to be planted between the rows of "nests" to protect the young pines against drought, without competing with them for water. Certain grasses which stop growing in May, and whose dry haulm, from 30-40 cm. tall, remains standing until autumn, have already been investigated for this purpose.

Logging and Engineering

India

• An FAO Technical Assistance officer writes: "While touring the forests of the Himalayas in winter, I have found that in these remote areas, almost all modern logging and transportation equipment is lacking although its introduction should be quite easy. Logging tools are of a low standard, most of them locally made by some village blacksmith. Forest roads are chiefly made by hand labor, even rock drilling. The personal equipment of the loggers and forest labor, such as shoes clothing and protection against cold, rain, snow, are of an extremely low standard. It is obvious that without being provided with better clothing and equipment these loggers will not be able to do a much better job than they carry out at the present time. Moreover, their quarters, sleeping and cooking accommodation while working in the woods consists only of grass and branch huts, shelters under rock cliffs, etc. No winter work is possible under such conditions although it would be very advisable to work throughout the colder season.

"I have been amazed to see that all forest work stops as soon as the first snow falls. In other countries loggers wait impatiently for snow, which is their best means of sliding and shuting logs by snow slides, sleds, sleighs, etc. Here no sled has ever been seen, although the existing forest paths are well suited for this type of transportation. I found it quite tragic that these people here carry all the timber from high and remote forests to the valleys during the summer months, not taking the least advantage of the facilities provided by the winter snow in areas above approx. 7,000 feet (2,100 m.). There is no doubt that logging as well as log transportation in the Himalayas can be improved to a very considerable extent. But new tools and methods would have to be demonstrated on the spot. The local populations are very conservative, and they would only be convinced of better tools and methods after having seen them in successful operation. A trained logging crew would have to demonstrate modern logging tools, their maintenance and repair, and the use of proper shoes, clothing for mountain logging, shelters for winter work (prefabricated, light and portable huts, including stoves), sleeping bags, etc."

Forest Injuries and Protection

United States of America

• Every oak tree in the United States is today under threat of destruction by what is potentially the most dangerous invader the forests have ever known. Even the chestnut blight that wiped out this species did not rival "oak wilt" in potential destructiveness. The chestnut was seldom more than a small fraction of the forest whereas in parts of the United States oak constitutes more than half the total tree cover.

Oak wilt, caused by a fungus, *Chalara quercina*, or more correctly *Ceratostomilla*, is now firmly entrenched in parts of eighteen states; in areas of Iowa and Wisconsin, mortality has reached 50 percent or more in some forests. At present the disease is incurable, although much research is being concentrated on combatting it. Special studies are being made of the method of dispersal, since the disease "jumps" for considerable distances.

Forest Management

United States of America

• The concept of land capability classes is not new, but its application to a large unit of widely varying conditions, as in a study entitled *Know California's Land*, by L. R. Wogletz and E. F. Dolder, is valuable in showing the fairly fixed limitations set by nature on types of land use, the discordance between actual and correct use of land, and the nature and extent of conservation practices which must be applied on high percentages of land to make the areas really useful for agriculture, forestry and grazing.

The land capability classes in the study are divided into three main groups:

1. four classes of land suitable for cultivation: Class I – very good land with no limitations; Class II – good land with minor limitations; Class III – moderately good land with major limitations; and Class IV – fairly good land with occasional cultivation and major limitations;
2. group of three classes suitable for range and forest use: Class V – suitable for range and woodland with no limitations; Class VI – suitable for range and woodland with minor limitations; Class VII – suitable for range and woodland with major limitations;
3. land suitable only for wildlife and watershed.

Since the natural watershed unit (drainage area) is obviously the best unit for study and action, each of the eight principal watersheds of the State is given separate treatment in this study, and prescriptions for proper conservation practices are described for each. This emphasizes the wide range of problems and the local changes in land use still to be worked out.

A single area, no matter how large or varied, cannot serve as a precise model for other areas, but this thoughtful analysis provides useful ideas on approach, classifications, and methods of work for other areas where use of the land capability method can mean that balanced attention is given to all kinds of lands and all kinds of land uses.

• In the southeastern United States the small owner of pine stumpage has long needed a simple method to determine whether it is more profitable to sell his pine timber for pulpwood or for saw timber. Tables are now available enabling him to decide for each diameter class likely to be in demand. The recovery ratio of standard cords to thousand board feet varies for each diameter class and, with this known, a comparison of the prices offered determines the size tree representing the dividing line between more profitable or less profitable sale for one purpose or another.

Industry and Trade

Argentina

• The extent to which Argentina imports timber is difficult to ascertain owing to non-availability of statistics. It is reported that softwood imports come from Brazil, North America and Europe. Hardwood imports derive mainly from Paraguay, but substantial quantities

come from Brazil, Bolivia and Chile. Brazil is favorably situated for the trade in timber but the quantities of pine and hardwoods exported depend on the volume of cereals moved from the Argentine to Brazil. There are also other factors: non-availability of shipping space, exchange difficulties, and Argentinian interests in the Paraguayan timber business.

There are said to be 50 plywood factories, of which the 37 that are registered have a capacity of 146,000 m³ and a production in 1951 of 55,000 m³, which is 25 percent in excess of national needs.

Consumers are turning to hardboards, imported mainly from Europe, and much ground has been lost by the plywood industry. A factory has now been installed in Argentina to produce hardboards. It is hoped to improve the quality of production this year; when this materializes, there may be prompt efforts to restrict imports.

Brazil

• It is reported that the main timber markets of Brazil hold prospects for the absorption of production from an expanded timber industry within the Amazon Valley. There is, in fact, a consumption potential within the Amazon Valley itself, which constitutes a vital market for secondary timbers and secondary specifications, and the stability of the industry is likely to devolve largely on its ability to dispose of such material effectively.

At present, general development in the Amazon appears to be at a slower tempo than elsewhere in Brazil. But it is a positive development. With the setting up of the Comissão de Valorização, and the development funds to be made available to it, progress in the Amazon Valley will inevitably be stepped up and become comparable to progress elsewhere in Brazil. This, in turn, will call for increasing quantities of commercial timber, both for domestic construction and for industry. There are grounds for belief, therefore, that an expanded timber industry in the Amazon will be supported by an adequate increase in commercial timber consumption within the Amazon Valley itself.

In addition there are supplies to the North East ports down to Pernambuco. Local supplies of hardwoods to these ports are not important. Hardwoods from the Rio Doce area gravitate normally to the Southern States, particularly to the Distrito Federal and Rio de Janeiro. Supplies from the Rio Doce forests are dwindling and it is unlikely that much can be diverted to the North East. The Amazon Valley is thus the natural source of hardwood supply to the North East ports, and the rate of development in these ports has been very rapid and is continuing. The corollary is a steady and immediate increase in consumption of hardwoods and it is to the Amazon that these North East ports will look for supplies.

Finally, there is the supply of hardwoods to the cities of Rio de Janeiro and São Paulo. The Amazon sends some timber, mainly cedro, to Rio de Janeiro, while its contribution to São Paulo's supply is insignificant. Up to the present, São Paulo has obtained its hardwoods from the forests in the State of São Paulo and neighboring states, but it is considered by reliable authorities that at the present rate of cutting, the commercially exploitable stands of timber in these forests will be exhausted in 10 years from now. It is therefore clear that before long both these cities, which between them consume more than 600,000 tons of hardwoods annually and are developing rapidly, will look for new sources of hardwood supply and there seems little alternative than that this timber must come from the Amazon. The present level of timber exports from the Amazon to all markets, home and abroad, is less than 60,000 tons annually.

Germany

• The significance and pattern of the German hardwood market may be gauged from the following approximate figures for imports during 1951:

	tons
Central and South America	20,270
Africa	158,860
Asia	2,200

Additional quantities of hardwoods were imported from the U.S.A., Canada and Japan. Brazil supplied 3,680 tons, chiefly from the Amazon, the main species being Louro Vermelho, Quaruba and Assacu. The main interest is now in Okume from Africa. Other African species are being received in quantities of sufficient magnitude to create a permanent interest in the market and to make publicity worthwhile.

Much research is being done at the Forest Institute at Reinbek on tropical woods and, though Brazil woods figure in the program, the work is mainly on African timbers. It is claimed that hard and soft tropical woods have been successfully mixed in the same cook and that a satisfactory paper has been produced from the result. The German authorities are also apparently interested in the possibility of using tropical hardwoods for sleepers.

New Zealand

• The largest forest utilization project of its kind in the Southern Hemisphere is nearing completion at Kinleith, 144 miles (232 km.) south of Auckland, New Zealand.

N. Z. Forest Products Ltd. has invested about N. Z. £7,000,000 in the enterprise which is situated in the strategic center of the company's 176,000 acres (71,000 ha.) of Monterey pine (*Pinus radiata*).

The company will produce a maximum of 45,000 tons of unbleached sulphate pulp annually, 12,500 tons of which has already been earmarked for export to Australia, for newsprint furnish. Kraft paper production from the mill alongside will be 25,000 tons yearly, to be used mainly for making into Bates multiwall bags and fiber containers at the company's Auckland plants, with any balance available for new Zealand converters.

Average daily output of sawn timber from the American bandsaw mill and the Swedish gangsaw mill, housed together in the same building, is 180,000 board feet (800 m³) daily. Annual sawn timber output from the company's four sawmills is 60 million board feet, (272,000 m³) the largest for any single organization in the Southern Hemisphere.

The water supply for the Kinleith pulp and paper mills will be pumped through 5½ miles (8.9 km.) of 32-inch (81 cm.) diameter spiral-welded pipes delivering 14½ million gallons (66 million liters) of water daily from a tributary of the Waikato River.

Other industries carried on by N. Z. Forest Products Ltd. at Auckland are the manufacture of "Pinex" fiber building board, boxes and shooks. A corrugated container plant is scheduled to commence operation early in 1953.

Tokoroa, a rapidly growing township, 4½ miles (7.2 km.) north of Kinleith, is the site of the company's housing project. Of over 600 employee houses planned, more than 300 have been completed and occupied.

Confidence in New Zealand-grown pine as a building material has been exemplified by N. Z. Forest Products Ltd., who have used it in all their houses and other wooden buildings.

Portugal

• Portugal exports mining timbers and cork but has a deficiency of hardwoods, which are imported mainly from Brazil and the Portuguese African territories.

1951 import figures were:

Hardwood logs	*Tons*	*Value in 1,000 Escudos*
Portuguese W. Africa	8 022	9 082
Brazil	15 795	18 459
Other countries	342	826
	24 159	28 367
Hardwood sawn		
Portuguese W. Africa	604	884
Brazil	984	1 591
Other countries	1 626	6 003
	3 214	8 481

Brazil is the most important source of hardwood imports, the trade being mainly in round logs. The trade is said to be difficult on account of exchange manipulations, one result of which is that parcels of the same species and specification arrive at different prices.

It is of interest that hitherto timbers from overseas Portuguese territories have been marketed abroad, despite the import duty on Brazil timber. Recently, however, more of these timbers are finding their way

into the Portuguese market, presumably owing to the difficult hardwood position in the United Kingdom and Germany during 1952. In normal circumstances over 90 percent of Mozambique timber production is exported by rail to South Africa and Southern Rhodesia. Angola and Guinea production now exceeds 30,000 tons annually. About a quarter finds its way to Portugal, but much is for re-export in the form of plywood.

Production in West Africa is on the increase and there appears to be some danger to sales of timber from Brazil, for the Portuguese market is a limited one. But the Amazon timbers are well-liked and established through long usage.

Sweden

• Logging operations in parts of Sweden today resemble a military campaign more than the peaceful harvesting of a natural bounty. The whole process of planting and growing timber, cutting it down and transporting it to mills is being scientifically streamlined. Every conceivable aspect is being mechanized. Airplanes chart maps, helicopters spray chemicals, flame throwers burn brush, tanks pack snow tracks, bulldozers tear out roads, dynamiters blast ditches, walkie-talkie sets transmit reports from and orders to the field, facilities for workers are being improved, and "lumberjills" have been added to the working force. Trucks and buses race along specially constructed roads to distant logging areas to debouch workers, horses, and equipment, often accompanied by mobile kitchens and mobile housing. On the "home front" science is busy producing better seeds, better conservation methods, better working methods and better tools. Photomicrography and time-and-motion studies are among the many methods being applied by the teams of researchers active both in the laboratory and in the field.

Forestland covers more than half the total area of Sweden and forest products are the backbone of the economy. As much as 55 percent of the country's export trade depends on it, and 25 percent of all industry is based on it. An abundant, cheap, and regular supply of raw logs is vital.

United States of America

• The American magazine *Time* is trying to develop overseas sources of paper for international editions in the countries where the magazine is printed, but few mills outside the U. S. are equipped to manufacture large quantities of paper with a coated surface. Most printing plants, however, purchase their ink locally, and only a relatively small amount is shipped from the U. S.

• Six plants of the Weyerhaeuser Timber Company in the Pacific Northwest are interconnected electrically with the Northwest Power pool and deliver approximately 1,500,000 kilowatt hours per week to the pool during any periods of shortages of electric power, while withdrawing less than 500,000. This is a net gain to the pool of more than a million kilowatt hours a week.

The production of power at Weyerhaeuser mills is one result of the firm's determination to use as much of the forest harvest as possible. In this instance, electrical energy is created from bark, sawdust and other sawmill left-overs that might otherwise be wasted.

Forest Products and their Utilization

Canada

• A Research Co-ordinating Committee on the Utilization of Sawmill Waste for Pulpwood was formed in 1951 with membership from the government, universities and industries. To date it has issued reports on *Bark Removal Methods and Machines*[1], *Portable and Small Stationary Type Chippers* and *The Handling and Transportation of Sawmill Waste for Pulpwood*. Each report describes the problems involved in different parts of Canada, the means available and under test for tackling them and the economic factors involved.

In the latter, the alternative methods of transportation are shipment of slabs and edgings as such to the pulp mill or conversion into chips at the sawmill, and shipment of the chips to the pulp mill. When a cord of slabs and edgings is converted into chips, it will occupy, on the average, 243 cubic feet (6.88 m³), or nearly three times the volume of the primary material, and this fact affects the costs of shipment by any available method. Moreover, many small unintegrated sawmills do not have, and cannot afford, the special chipping and conveyor machinery needed to convert slabs into chips at the plant. Thus, the eventual organization of sawmill waste utilization for pulp will vary, depending on various factors, but on the whole it is believed that a great increase in present utilization can be worked out.

• The Federal Forestry Branch organizes annual lumber seasoning courses at the Forest Products Laboratory, Ottawa. These courses are intended primarily to provide training in the kiln-drying of lumber for those whose duties are connected with the operation of dry kilns. They are, however, sufficiently broad in scope to be of interest and value to all who are interested in the seasoning of lumber and other wood products. The lectures, instruction and demonstrations for the course are planned to emphasize procedures and precautions necessary to obtain and maintain high standards in all phases of lumber seasoning.

The following is an outline of the main subjects covered during the latest course held over a five-day period in February 1953: *significance* of wood-using industries in the Canadian economy: *commercial species*, woods used in eastern Canada, and their identification: *cellular structure* of wood and its effect on seasoning: *mechanical properties*, moisture, strength relations and other factors: *seasoning of wood*, advantages of good seasoning and the factors controlling drying: *air-seasoning*, method of piling, rate of drying, etc.: *kiln-drying*, kilns, types, design, etc.; temperature, humidity and circulation in kiln-drying; moisture content, how measured, electric moisture meters, use of test boards to measure drying rates; control instruments and other kiln equipment; drying schedules; seasoning defects and how they are overcome; storing and shipping of seasoned lumber: *other methods* of seasoning such as vapor drying, solvent drying, chemical seasoning, dielectric heating, infrared, high-temperature, etc.; *decay and stain* in lumber, moisture content relations, effect of seasoning, etc.: *costs* to woodworking industries.

No charge is made for these courses, but owing to space limitations, only a single representative is accepted from any one firm.

Japan

• A recent mission from the Japanese Government and Japanese pulp and timber industries visited the United States to investigate the possibility of obtaining supplies of forest products from Alaska. At present rates of cutting, Japan's own softwood resources will be nearly exhausted within the next decade and a half. It is therefore imperative to find supplementary sources.

Under existing U. S. law and practice, importation of forest workers would be difficult as long as American workers were available. Any enterprise sponsored by Japan would, moreover, have to be incorporated under American law, bid successfully and competitively for National Forest stumpage, and conform to laws, regulations and contract terms in the same manner as American firms.

United States of America

• For over 20 years the personnel of the Naval Stores Research Division of the U. S. Department of Agriculture, Bureau of Agricultural and Industrial Chemistry, have published many papers dealing with the production, uses, composition, specifications, analytical methods, chemical and physical properties, scientific and technical information of naval stores. A bibliography of these

[1] See *Unasylva*, Vol. V, No. 2, p. 91.

papers is periodically brought up to date by supplements, including only papers believed to be still applicable and significant.

Forest Policy

Canada

• The first annual statistical series in Canada, covering lumber and wood pulp production, were begun in 1908. At intervals until 1926, additional series were started, covering utilization, depletion and waste. Forest inventories continued to add information on total forest area and its breakdown into productive accessible forests, and into non-productive forests. The Government, through the Forestry Branch of the Department of Resources and Development, periodically revises and brings up to date all such information in two forms, first, a series of 28 statistical tables, together with charts, and, second, a bulletin with some tables and charts, but including information not available in the statistical bulletin.

The total forested area is now given as 1.3 million square miles (336.7 million ha.), making up 37 percent of the total land area. Productive forests make up 20 percent of the land area; about 67 percent of these are accessible. About 40 percent of this area has trees large enough for commercial use, and the remainder is in young growth. It is estimated that annual per-acre growth of 11 cu. ft. (0.78 m^3 per ha.) on the accessible area will be required to maintain production at present levels. Crown lands constitute 67 percent of present forest land and privately owned lands the remainder.

Utilization averaging about 3,515 million cu. ft. (99.5 million m^3) annually during the past decade has made up about 80 percent of the total average annual depletion, the remainder being accounted for by fire, insects and disease. Fires average about 5,400 in number, and burn over 2 million acres (800,000 ha.) annually, about ⅓ of which is in young growth and cutover land.

The trend in all forms of forest production in both volume and value, number of industrial establishments, labor employment and apparent domestic consumption, has been steeply upward. Total industrial production has risen from 2,137 million cu. ft. (60.5 million m^3) in 1938 to 3,140 million (89 million m^3) in 1949, and from $310 million to $1,373 million in the same years. Forestry now accounts for one quarter of the total primary production in Canada and for about one sixth of secondary production. In terms of the trade balance, forestry produces a credit balance of nearly $800 million, and is responsible for the favorable balance for all products: which is about $250 million.

Employment in forest industries increased from 175,000 employees receiving $182 million in 1938, to 324,000 employees receiving $754 million in 1949. In value of production, the sawmilling and pulpwood industries were almost equal in 1938 at about $53 million each, whereas by 1949 the pulpwood industry produced $271 million compared with $208 million for the sawmilling industry. The province of British Columbia continues to dominate in lumber production, followed by Quebec and Ontario, whereas in total forest production Quebec leads, followed by Ontario and British Columbia. The number of lumber industry establishments is now nearly 7,500, having about doubled since 1938; pulp and paper establishments have increased from 99 to 123 during the same period. There are over 3,700 wood-using industries and over 400 paper industries.

Between 1938 and 1949, apparent domestic consumption of primary forest products increased from 1,900 million to 3,000 million cu. ft. (54 to 85 million m^3); of lumber from 2,100 million to 3,800 million board feet (9.5 to 17.2 million m^3); of wood pulp from 3.1 million to 6.3 million tons, all reflecting the vigorous and expanding economy of the country.

Iceland

• A note on forestry in Iceland appeared in a previous issue of *Unasylva* (Vol. VI, No. 2, p. 93). Since then FAO has, under the Technical Assistance Program, sent a technical forester from Alaska to discuss and advise on the country's forestry program. This officer has now made his report to the Government.

Iceland has no forest resources and is dependent upon imports for all timber used. Between 1947 and 1951 imports, about 90 percent softwoods, averaged around 65,000 m^3 annually, costing about 1.8 million U.S. dollars. The Forest Service, with the help of the Iceland Forest Association, expects to plant conifers on 32,000 hectares of brushland over the next 100 years. At conservative growth rates, this will produce yearly at least as much timber as is now imported.

Meanwhile the whole program depends on importing seed from proper seed sources because new plantations could not produce sufficient native seed for 30 to 40 years. Among his recommendations, the Technical Assistance officer suggests that arrangements be made for the purchase of tree seed of several Alaska species as yet not fully tested in Iceland, particularly lodgepole pine (*P. contorta*), mountain hemlock (*Tsuga mertensiana*), Eastern larch from central Alaska (*Larix laricina*), Western hemlock (*Tsuga heterophylla*) and Sitka spruce from glacial moraines. A 5-year period for collecting sufficient amounts would be necessary.

The methods now used in growing seed in nurseries are resourceful and planting out has been successful so far as it has gone. Controlled experiments are needed with reference to seed source, nursery treatment and methods of planting out under various conditions. Fencing is necessary to prevent the destruction of the brush cover and plantations by sheep; fenced land soon recovers its vegetative cover while unfenced land is eroding. In fact, Iceland has a much bigger land use problem than that of growing timber; sheep and cattle grazing have eroded the land to an incredible degree. This could be controlled by proper range management. Shelterbelts and windbreaks appear to be needed to arrest the constant wind which is Iceland's chief enemy. The hardiest and least exacting pioneer species, *Salix* for instance, might be used for initial plantings.

Malaya

• The following is a statement of the interim forest policy of the State Governments of Malaya:

I

1. To reserve permanently, for the benefit of the present and future inhabitants of the country, forest land sufficient

   (*i*) to ensure the sound climatic and physical condition of the country, the safeguarding of water supplies and soil fertility, and the prevention of damage by flooding and erosion to rivers and padi and other agricultural land; such reserves are known as *Protective Reserves*,

   (*ii*) for the supply in perpetuity at reasonable rates, of all forms of forest produce which can be economically produced within the country and required by the people for agricultural, domestic and industrial purposes; such reserves are known as *Productive Reserves*.

2. To manage the Forest Estate with the object of obtaining the highest revenue compatible with sustained yield, and with the two primary objects set out above.

3. To foster, by education and propaganda, a real understanding among the people of Malaya of the value of forest to them and their descendants.

II

1. Protective Reserves should never be alienated, save in the most exceptional circumstances and after the most careful and detached inquiry. One of the purposes of such inquiry will be to ensure that alternative protective measures are practicable and can be enforced.

III

1. In order to provide conveniently for the requirements of the population, productive Forest Reserves should be widely distributed throughout the country. The present aim should be

to ensure that each District has a reasonable percentage of its area reserved as productive forest and that over the country as a whole, up to 25 percent of the land area is set aside for timber production.

2. Forest Reserves are constituted by Government, after careful enquiry, for productive or protective reasons and are not available for other purposes. Long-term planning and security of tenure are essential for the successful management of the Forest Estate.

3. Therefore applications for excisions from Productive Forest Reserve will not normally be considered except for:

(a) the permanent cultivation of wet rice;
(b) the mining of minerals;
(c) the development of agriculture on soils which, in the opinion of the Department of Agriculture, are of sufficient fertility to support permanent agricultural crops on an economic basis:

and then only if:

(a) the aggregate area of forest reserve in the District is not, as a result, reduced below a reasonable percentage or,
(b) an equivalent area is made available for reservation.

Only in exceptional circumstances will applications for excisions from Forest Reserve be considered if they rest primarily on grounds of easy accessibility or convenience to the applicant.

4. In leases relating to the mining of minerals suitable provisions shall be inserted to ensure that water supplies required for other purposes are not polluted, that protective measures are taken where there is risk of serious soil erosion and that mining operations are conducted in such a manner as to ensure that soil cover is restored.

5. Government is responsible for the management of the Forest Estate, and, to ensure its proper maintenance, it is recognized that a proportion of the revenue derived from it should be reinvested in the form of silvicultural operations and other works of improvement. A sum equal to approximately 10 percent of the gross revenue is accepted as adequate for this purpose at present.

6. Since the forest policy of Malaya is an integration of the policies of the territories which comprise it, any departure from accepted principles on the part of one Administration must affect the others, and the country as a whole. It is therefore urged that all States and Settlements in the Federation of Malaya, in accepting this interim policy, will also accept the advice of the Department of Forestry in implementing it.

United Kingdom

• Proof of the increasing interest in non-forest plantations, for example hedgerow and farm timber, is shown by the recent appointment by the Minister of Agriculture and the Secretary of State for Scotland of a Committee to advise the Forestry Commissioners on this problem. The Commissioners are particularly anxious to ensure that hedgerow timber, a large part of which is overmature and consequently licensed for felling each year, should be replaced.

The Committee's terms of reference are: "In view of the national need to promote timber production, to examine the extent to which the growth of hedgerow timber is compatible with good agricultural practice; and to make recommendations as to the best means of securing the planting and tending of hedgerow timber."

Venezuela

• The Rural Welfare Council of Venezuela, a private concern receiving financial and administrative assistance from the Government, has as its main object to increase agricultural output and to raise the standard of living among farmers. In December 1951, the Council was requested by the Ministry of Agriculture to report on the organization of the Forest Service with the collaboration of E. W. Loveridge, Assistant Chief of the U.S. Forest Service.

The report, which was published in June 1952, contained recommendations for the reorganization of the Forest Service with a structure similar to that of the U.S. Forest Service but with certain simplifications. The issue was complicated by the large variety of functions carried out by the Venezuelan Forest Service, ranging from administration of the Botanic Institute, soil and water conservation, forest research, administration of public forests and control of private forests, fire prevention measures, range management, and the responsibility for all renewable natural resources.

The present deficiencies of the Service are said to be due largely to lack of trained personnel and the present forestry legislation, the first of which is being remedied by the work of the Forestry Faculty of the University of Merida, and the second by new legislation.

Selected Reviews

CONSERVATION EDUCATION IN AMERICAN SCHOOLS. American Association of School Administrators. 1952. pp. 527. Washington, D. C. U.S. $4.00.

This publication is the 1951 yearbook of the American Association of School Administrators which, at the end of 1950, had 7,734 members. Two-thirds of its 527 pages are devoted to a problem of interest to every forester, namely, the education of the public, and particularly young people, with regard to the conservation of natural resources.

The problem is treated here in relation to the American system of education, but the principles underlying education in general, and conservation education in particular, are applicable everywhere. But although the authors rightly dwell at length on the efforts made in the United States to promote conservation, such as the work of the Committee on Southern Regional Studies and Education, and the success achieved, they recognize that even in the United States there is still a vast amount to be done in this field, as indeed in most countries of the world, many of which unfortunately have as yet made no effort to tackle the problem. That is why this book has a significance that reaches far beyond the boundaries of the country for which it was written.

Some may even wonder whether conservation of renewable or non-renewable natural resources is really a subject for instruction in schools, but if the view is taken that it has an important part to play in raising standards of living and that it should be "(a) helping citizens to become more fully aware of the problems of society, and (b) studying these problems with the view of improving the conditions for living, and ways of living," then it is clearly a subject to be included in the curricula of all types of school.

The school can thus become the starting point of a new conception of living for the whole community. All foresters are fully aware that the most carefully thought-out forest policy, the most appropriate legislation and the best organized forest service are of very little avail without the support of an enlightened public opinion. Starting from these principles, Chapter 3 gives a list of basic concepts for a sound program of conservation education.

"Conservation of natural resources means the wise use of natural resources for the greatest good of the largest number of people for the longest time." Then, "natural resources must be thought of as having an essential unity rather than as separate categories. They are interrelated and interdependent. This unity, the closely linked interdependence of soil, water, minerals, plants, animals and man, constitutes the seamless web of life and matter."

Chapter 3 also contains some valuable conservation education guides:

"Conservation education programs should start with a consideration of community environment and needs, then evolve into a consideration of state, regional, national and international aspects"; and "schools should co-operate with community, state, regional, and national agencies (governmentall and non-governmental), which are concerned with resource use."

The question is raised as to whether conservation education should be the subject of special courses or linked with, or integrated into, general school programs. Preference is given to the latter solution, which would appear to be the right one, since by such integration the idea of conservation is rendered more familiar to pupils and more effectively impressed upon them.

While the chapter which has been dealt with at length is of special interest, the other chapters are also worth reading attentively. They contain useful suggestions on "materials" for instruction in conservation such as textbooks, newspapers (since such instruction must also reach adults), films and slides (of which selected reference lists are given), radio programs, and discuss the principles that should govern the selection of the materials most suitable for each class. There are also suggestions with particular reference to rural schools and others applicable to city schools. Two important chapters also deal with the training of teachers and the responsibility of school administrators in this regard.

FOREST ENGINEERING - ROADS AND BRIDGES. James L. Harrison. pp.366. Oliver and Boyd. Edinburgh and London. 1951. 30 shillings.

The author, formerly of the Indian Forest Service, is concerned with the road and bridge problems with which forest officers have to deal — roads that do not come in the category of major highways, but rather more modest ways suited to the loads and extraction methods of the particular area, and bridges which are not massive structures of steel and concrete, but simpler structures in which readily available timber may be used.

In such forest engineering the need for and advantages of good design, knowledge of materials, selection of construction methods and sound engineering practices in general are fully as great as for more imposing edifices. The author's bias in favor of the simple and economical, making the fullest use of native materials near the site, and combining these with sound engineering, has resulted in a work specifically for the forest officer who deals with forest road and bridge problems within his competence, and should help him in producing enduring structures.

FOREST ENTOMOLOGY. Samuel Alexander Graham. 1952. pp. 351. American Forestry Series. McGraw-Hill Book Co., Inc. New York, Toronto, London. U.S. $6.00.

Forest entomology has, in recent years, gone far beyond the earlier stage of cataloguing and describing forest insects. Development of synthetic insecticides and their application by aircraft have opened the way to large-scale control operations, hitherto impossible. Of at least equal importance, knowledge of insect ecology, of the characteristics of forest stands and of individual trees which make them susceptible or immune to insect attack, have made entomology an integral part of silviculture and management. Aerial surveying and photography have made really good insect surveys practicable.

Since this is a time of exploration and of rapid advance in principles and practice in control, this publication, nominally a third edition, is virtually a new work. Particular species of insects are dealt with, less for their own sake than to illustrate methods of direct control by chemicals, methods of indirect control by parasites and predators, and by silvicultural practices.

As the scope of forest entomology widens, it becomes more and more necessary for foresters to learn new methods and relationships, notably how to utilize cuttings to increase resistance of residual trees and stands to attack.

TEXTBOOK OF WOOD TECHNOLOGY, Vol. 2. H. P. Brown, A. J. Panshin and C. C. Forsaith. 1952. pp. 783. McGraw-Hill Book Co., Inc. New York, Toronto, London. U.S. $10.00.

This long anticipated second volume evokes the deep regret of all researchmen for the death of H. P. Brown, one of the outstanding authorities in the field of wood technology. It completes a work the first volume of which constituted also the first of the famous "American Forestry Series" in 1934, under the title *Identification of the Commercial Timbers of the United States*, and became the foremost handbook of its kind.

This second volume, subtitled "The Physical, Mechanical and Chemical Properties of the Commercial Woods of the United States", brings together the results of related modern research in concise form.

After the discussion of the physical properties — density, relation to moisture, heat, sound, light and electricity — there follows a short chapter on the bonding and finishing of wood, and then a study of the mechanical properties of wood including a thorough discussion of the mechanics of solid woods, wood connectors and laminated products, stress analysis, testing procedures and practical tables for allowable loads, spacing of connectors, etc.

Part 3, "Chemical Properties of Wood", is in comparison with Part 2 only an introduction to the composition of the cell wall and the extraneous components of wood, its chemical treatment, thermal reactions and decomposition by biological agents.

The choice of only a limited number of references for each chapter as well as the extensive use of definite problems with the complete development of the answers will help to introduce modern and economic utilization of wood into all countries.

LOGGING MECHANIZATION IN THE USSR. A. Koroleff. pp. 158. Illus. Pulp and Paper Research Institute of Canada, Montreal. 1952. $5.00.

This book combines a detailed discussion of logging machinery and techniques of mechanized logging as now used in many forest regions of the USSR, and a story of how a backward timber industry based on casual manual labor and horse logging has within a dozen years been converted into a highly mechanized industry, comparable to that of the U.S. and Canada.

The author is well qualified to deal with the subject. A graduate of the St. Petersburg Imperial Forest Institute (now Leningrad Academy of Forest Technology), one of the oldest forest schools in Europe (founded in 1803), he was sent by the Kerensky Government to study logging mechanization on the North American Continent. He did not go back to Russia but continued his specialized studies at Yale and at the University of Washington. For a number of years now he has been Director of the Woodlands Research Division of the Pulp and Paper Research Institute of Canada.

The material on which the book is based has been taken from about a hundred technical articles, translated by the author himself, published since 1947 in the Russian monthly Timber Trade Journal *Lesnaya Promyshlennost* (Forest Industry), the official organ of the Ministry of Forest Industries of the USSR. Some material has also been taken from *Unasylva*.

It is in the field of power development and application that the book is of first-rate technical interest. The fundamental principle has been that the forest should provide the power necessary for its own working. At present about 10 percent of the total wood involved in Russian logging operations, including some slash, is used as fuel for power production. This percentage is to be substantially increased. It was expected that "by the end of 1950 at least 70 percent of logging trucks and tractors should be operated on producer gas (wood)." Electricity is regarded as of prime efficiency and electric power stations are favored at key points to provide all the power necessary for cutting, skidding (cable or tractor) loading, etc. Where electrification is impracticable, producer gas is applied and machines including tractors operating on green-wood have been developed for the purpose. In effect what would otherwise be wood waste is put to power production of electricity or gas. This has naturally favored whole tree extraction to the points of power production, and considerable work has been done to develop techniques of logging unbranched trees.

It is of particular interest that whereas the U.S. Forest Service Tomcat tractor has not progressed into routine production in the United States, tractors of similar type, designed purely for log extraction, are standard in the USSR — a 2-ton machine for use with selection cutting, a 5 or 6-ton tractor for skidding under the conditions which generally prevail in stands of 23-30 cords per acre (57-74 cords per ha.), and 10 or 12-ton tractor for use in large timber. Chainsaws have been developed which operate from a 12 kw. portable electric power station and weigh as little as 18 lb (8 kg.).

The book serves a useful purpose by acquainting the timber operators of other countries with the status, progress and trends of the logging industry in the USSR, information which is very difficult to obtain. The subject matter is treated critically but with restraint and objectivity, interestingly presented and easily readable. The lesson which the author sought to drive home is to show that, allowing for some extravagant claims, the rate of increase in efficiency of logging in the USSR is high, and that this increase is due to energetic efforts in logging mechanization and strong support for research. If other countries are to retain their prominent positions as timber exporters, research in logging mechanization and efficiency should receive much greater emphasis.

THE TROPICAL RAIN FOREST. An ecological study. P. W. Richards, pp. 50. Illus. Cambridge University Press, London, and New York. 1952. $12.50.

Any ecological study of a commercially valuable forest type or group of types, while perhaps not of interest to loggers and the timber trade, is, in this case at least, important to foresters and other scientists concerned with management and research in the tropical rain forests of the world. The author, drawing on his short but intensive experience in tropical forests in South America, Africa, Malaya and Borneo, as well as on the available literature, deals not with the economic aspects of the tropical forests but approaches his subject from the standpoint of "a plant community or an environment." He aims his comprehensive work not only at foresters and botanists, but also at zoologists and geographers — in other words, the technicians. His style and methods of presentation, however, will certainly make this book appeal to "those not trained as professional botanists."

He describes the structure, regeneration, development and habits of the trees and associated vegetation; the climate, microclimate, seasonal changes and soil conditions as the outstanding elements of the environment; the composition of various forest communities and of mixed forest as a climax; primary successions on dry and wet sites, and tells of the succession along coasts on sandy and muddy shores. He gives particular attention to the rain forest, deciduous forest, and savannah, and to the tropical rain forests at upper and lower altitudinal limits as well as at their north and south boundaries, and compares the conditions at both altitudinal and latitudinal extremes. He also deals briefly with secondary succession induced by action of man, such as clearing for cultivation and fire, and by action of storms.

In the final pages, which the author calls a postscript, there is a discussion of the future of the tropical rain forest. Rather it is an expression of fear that because of the rate and manner of exploitation in many areas, the tropical rain forest may be completely destroyed. The plea is for preserving important segments of the tropical rain forest for scientific research purposes — and certainly there should be no serious opposition to this objective. But it is precisely here that, on the basis of ecological information such as Dr. Richards presents, the forester should play his role of developing a silviculture which will perpetuate the tropical rain forest — not as an undisturbed outdoor laboratory but as a continuously productive source of important forest products.

Roma, 1953 - S.p.A. Tipografica Castaldi, Via Casilina, 49

THE Nations accepting this Constitution, being determined to promote the common welfare by furthering separate and collective action on their part for the purposes of

raising levels of nutrition and standards of living of the peoples under respective jurisdictions,

securing improvements in the efficiency of the production and distribution of all food and agricultural products,

bettering the condition of rural populations,

and thus contributing toward an expanding world economy,

hereby establish the Food and Agriculture Organization of the United Nations... through which the Members will report to one another on the measures taken and the progress achieved in the fields of action set forth above.

—Preamble to the Constitution of the Food and Agriculture Organization of the United Nations

FAO Member Nations

AFGHANISTAN
ARGENTINA
AUSTRALIA
AUSTRIA
BELGIUM
BOLIVIA
BRAZIL
BURMA
CAMBODIA
CANADA
CEYLON
CHILE
COLOMBIA
COSTA RICA
CUBA
DENMARK
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
ETHIOPIA
FINLAND
FRANCE
GERMANY
GREECE
GUATEMALA
HAITI
HONDURAS
ICELAND
INDIA
INDONESIA
IRAQ
IRELAND
ISRAEL
ITALY
JAPAN
JORDAN
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